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Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By JELINGER C. SYMONS, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[CONTINUED FROM PAGE 81.]

Facts from Factories, and Sketches of the Produce in France and Belgium.

France.—The following are the prices of some of the chief muslin manufactures of Mulhause.

Jaconet 15°° 35 inches wide, chains No. 100s, weft 130s, 30 shots in the quarter of an inch. Sale price 1*s.* per ell of 44 inches. Wages for weaving, 5 sols. (2½*d.*) per ell.

2. A striped muslin 15°° 35 inches wide, 2 shots over for printing, was 1 fr. 50 cent. per ell (or 1*s.* 3*d.*;) of this considerable quantities were made, the weavers gaining between 6 and 8 fr. per week on them.

3. Fine calico 14°°, 35 inches, 2 shots over, warp much thicker than weft; very evenly wove cloth; 12 sols. *(6d.)* per ell of 44 inches. Calicoes range from this price to 10*d.* per ell, and some as high as 1 fr. 40 cent., according to the width.

Our manufacturers have not much to dread from Alsatian competition, excepting inasmuch as the protecting duties (which are the main cause of the backwardness of Mulhausen manufactures) prevent our articles from entering the French market. They are obliged to draw all their cotton through Havre or Marseilles, it being prohibited to them to have it from Hamburg, Trieste, or any foreign port, however much more convenient to

them. Coals also cost them exceedingly high:—(4 fr. 70 cent. per 100 kilogrammes, *i. e.* 3*s.* 11*d.* per 220 lb.)

The erection of a mill, machinery, &c. included, costs about 30 fr. (24*s.* 2*d.*) per spindle, and they calculate that a 30-horse steam-engine requisite for 18,000 or 20,000 spindles, consumes 2250 kilogrammes per day of 13 hours' work, and costs about 45,000 fr.

Previous to the modification of the prohibition of the import of foreign twist, the Mulhausen mills spun yarns up to No. 250s; but since our twist is admitted as low as 170s on the payment of a slight duty, they have ceased to spin any high numbers; a result for which the manufacturers give almost any reason but the true one,—namely, the incontestible superiority of the produce of Manchester and Glasgow.

The following are answers given by Mr. Schlumberguer, to some written questions which I put to him on the comparative economy, &c. of the French cotton-mills.

There are some very large spinning-mills at Mulhause, and in other parts of Alsace. They are, however, by no means in a flourishing condition, owing to various causes; among others, the high protecting duty, which the tariff of France imposes on the importation of foreign iron, in order, as I was told in Normany, to protect the monopoly of about fifty proprietors of indigenous iron mines.

The Messrs. MacCulloch, of Glasgow, have a finishing establishment at Tarare, the only one in that part of France; and, though their prices are said to be extremely high, they finish the Tarare goods in a style fully equal to that of Glasgow. They purchase all the fine yarn spun by Messrs. Houldsworth of Manchester which is sent to France, and supply the French manufacturers with it. Not only do the Tarare manufacturers find it their interest to pay the duty, carriage, and commission, on the finest yarns (above 170s,) but they buy all the yarns they use above 120s from Manchester also. It is sent sealed through France into Switzerland, paying the transit dues; and from Switzerland it is smuggled back again to Tarare by way of Chambery.

I have it on the best authority, and am prepared with evidence to its truth, that Tarare alone consumes L.40,000 Sterling of English cotton twist, one-third of which are Nos. below 170s, and consequently contraband; the rest in numbers up to 320s. The cost of smuggling these yarns into France varies from 30 to 40 per cent. on the value; which the "protecting duty" on the French manufacture gives to the Swiss smuggler, and certainly a very handsome present it is. It is impossible to converse ten minutes with a French manufacturer, without discovering some injurious effect of her benighted commercial system; and consequently of the infatuation of restrictions on international commerce.

I have already noticed the lowness of the hand-loom wages of Normandy.

I proceed to establish this, and the cheapness of the goods produced from patterns, and their prices, which I carefully collected at Rouen, &c.

1. Checked pullicate 10^{00} 33 inches by 30, Nos. 20, chain 35 weft. Wages 24 fr. for 16 dozen woven in about 20 days. Price per dozen 6 fr.

2. Do. 12^{00} 2 shots over. Turkey-red coloured check, best colour, yard square. Wages 39 fr. for 11 dozen. Sale price 13 fr.

3. Thick blue twilled calicoes for men's smock frocks, 10^{00} 45 inches

wide, coarse yarn. Wages 46 fr. for 120 ells, woven in 35 days. Price 1 fr. 86 cent. to 2 fr., 8 or 10 per cent. discount for cash.

These are gross wages: there will fall to be deducted loom-rent, fuel, light, agency, &c., which may be thus estimated, taking the article number 3 as a standard. 1. Agency 5 fr. (including the use of reed which the agent furnishes,) light and fuel 3 sols per day (1½*d.*) Other incidentals, wear and tear, &c. 3 fr. 50 cent. making 10 fr. 10 cent., which, deducted from the 46 fr. gross wages in 35 days, leaves as nearly as possible, 1 fr. per day or 5*s.* per week. This may be taken as above rather than below the average, which fluctuates according to the immediate demand, &c. &c., from 5 to 6 fr. weekly. Children and women are both occupied in weaving at proportionate earnings. About 4 fr. is given over the above for winding.

The manufacturers of Rouen pride themselves greatly on the superiority of these productions. And it is but justice to them to say, that I have seldom seen printed cottons so good, in colour and texture at 32 inches width for 7*d.* per ell of 44 inches, as those of Rouen at that price. They told me that they felt assured of being able very soon to compete in these articles with Manchester in third markets. I have before me a multitude of patterns from which these prices have been taken, and which I collected throughout the extent of my journey. These patterns I intend presenting to the Manchester Chamber of Commerce; and I cannot but recommend to the Government the duty incumbent on it to take means for obtaining periodical supplies of these patterns from every part of the manufacturing world. These are precisely the first duties a Government owes to the industry of a country; and are the protections alone due or useful to it; and at the same time those which our Government utterly neglects. The King of the Belgians has established a splendid gallery of models of all the first-rate mechanical inventions of other countries at Brussels, (many drawn from England:) it is constantly supplied with all new patterns, and artists have free admission. It is no slight stigma on us that we have nothing of the kind; if we except the interesting peep show at the Adelaide Gallery.

The silks of France have long been pre-eminent for their beauty, and any description of mine would be wholly superfluous, in a country where the produce of the Lyonese looms are abundantly known.

The number of looms in Lyons and its environs has fluctuated considerably. In 1788, a census, made by order of the consuls, gave 14,777 looms, of which 5442 were idle, owing to some sudden and temporary caprice of female fashion. The workmen of all sorts employed were 58,500. In 1801, the looms had fallen to 7000, owing to the war and other causes. In 1834, the number of looms was 17,281, of which 1358 were idle. The master weavers occupy about 7000, the compagnons 6854, and the children and apprentices 2500. This was the Prefet's estimate four years ago, and as many again were then estimated in the suburbs. Now a larger number belong to the latter, but the aggregate will scarcely be much increased.

The gross produce of the Lyonese looms was estimated in 1838, at 135 millions of francs value per annum.

The French beat us almost entirely in silks, through the elegance of their designs, and the rapidity with which they are produced. As I have already stated, this is wholly owing to their Schools of Arts institutions there supported liberally by the government; whilst here, the schools we have are both inefficient and trammeled with the absurdest regulations as to pupils adhering to the exact branch in which they enter, whatever difference of capacity they may afterwards exhibit.*

* I have learned from Mr. Wyse that this is now amended.

There are some very large cotton spinning mills in St. Quentin; those of Messrs. Houldsworth and Brewer, Englishmen, are among the largest; and several likewise in the vicinity, as well as in the Departement du Nord.

The Messrs. Tausin and MacCulloch (brother to the gentleman at Tarare) have here the largest finishing establishment in France.

In St. Quentin and the environs there are about 700 bobbinet frames; to each of these there are two workmen, whose wages do not exceed 1 fr. 50 cent. to 1 fr. 75 cent. per day. These descriptions of frames are scarcely sufficiently profitable to be worked at all, the demand declining constantly in this branch of the trade. There are, however, 40 or 50 Meckling frames, for the produce of which a considerable demand has arisen, and on which the wages amount to 6 and 7 francs per day. Several new frames are now making for this work, and, of course, both the profits of the manufacturer (at present immense) and the wages of the workmen will fall ere long. English yarn was exclusively used for these goods, but French yarn has come latterly much into use. The silk spinners now supply many of the Tulle manufacturers. I have heard, however, complaints that yarns are often sold for finer than they are, the length being deficient.

Bobbinet forms the only manufacture of Calais; it was introduced there from Nottingham twenty years ago, and the same machines for the common net continue to be used, which cost about L.100 each. There are about 400 of these machines in and near Calais, 100 of the fancy net machines, and 40 of what are called tatting machines.

A great number of these tulle weavers are Englishmen, who are domiciled at Calais. The tulle trade is very much on the decline there, with the exception of the fancy lace, which is made only by two houses, viz. Webster and Wragg, Englishmen, and Champoillon, a Frenchman; and although the trade in this article succeeds tolerably well at present, it cannot be said to be very brisk.

The cotton trade of France is much cramped by protecting duties. The production of the French mills will average 62,400,000 lbs. of cotton yarn per year. Mr. Schlumberguer, evidently lamenting over the fallen condition of his trade, writes, as we have seen, on the profits made by the French spinners:

"I confess I wonder how it is that the French spinners manage as well as they do, considering the fearful drawbacks they encounter. In the first place, about forty or fifty people have iron mines, and therewith a monopoly. All foreign iron is alone admitted at a high protecting, in effect a prohibitive, duty. This greatly increases the cost of machinery, and by rendering a large capital necessary to start business as an engineer, creates a *second monopoly* in machine making. Secondly, coal is protected, and Mons. Fauquet Lemaitre, of Bolbec, Normandy, assured me that he paid a duty on his English coal higher than the prime cost at Manchester. Then Le Havre and Marseilles have got their protection, and nobody in France, no matter on which side of it he live, can buy a single bale of cotton which has not paid harbour dues at one of these two ports: which, happening to be at the south and west of France, are of course peculiarly convenient for the extensive spinning mills established in the west and north. The whole commerce of France is, in fact, crippled and withered by these insane fetters."

Belgium.—The cotton manufacture in Belgium is said to represent a capital of 60,000,000 francs. Gand, Malines, and the district between these towns, is the locality of the cotton industry; Gand being the head-

quarters of the spinners. The produce of the looms amounted two years ago, to about a million and a half pieces of ginghams or coarse cotton and calicoes, and 400,000 pieces of printed cottons. An increase of about 20 per cent. has taken place since.

I had a long conversation with Mons. de Bast, of Gand, the president of the *Société Colonnière*, to whom I was introduced by a letter from the king's private secretary. The following are among the most interesting of the various points we discussed, and of the subsequent observations I made at Gand.

The number of spindles in the cotton mills of Belgium, just before the revolution, amounted to 300,000 in Gand, and about 100,000 out of Gand. A diminution took place after that event, to which Mr. Baines alludes in his work on the Cotton Trade, p. 526, and the spindles in activity were reduced by at least 25 per cent., up to the 1st January, 1835, when 301,145 only were in activity. At the present time, the number employed exceeds 400,000. The steam engines represent about 1000 horse power.

M. de Bast was of opinion, that though the labour of individuals was cheaper in Belgium than in England, the advantage had been greatly overrated; because, first, the Belgian work people work like mere automata, mechanically, whereas, he believes, in England, they are far more skilled and interested in the art, and are able to explain the machinery, which they are not in Belgium. Again, he is of opinion, that owing *hitherto* to the decided inferiority of Belgian to English machinery, many more persons are needed in Gand than in Manchester to perform the operations which come in the class of preparations. This disadvantage is, however, on the point of being forthwith entirely removed; and new carding and drawing machinery, modeled on a combination of our best and most recent inventions, is now in progress for more than one of the largest mills of Belgium. I could not write a description of the mechanical difference to which I allude, but its effects may be understood by the diminution of labour it will cause in a mill of 18,000 spindles, and whereby 41 hands will suffice, where 72 are now employed. The fact is, that foreign manufacturers are only beginning to realize to themselves the full power which the cheapness of labour offers to them, by uniting it with the advantages of improved machinery, in the construction of which, they are abundantly aided by denizen engineers from England. In addition to new carding and bobbing frames, they are introducing self-acting mules.

Mules are almost universally preferred to throstles, (of which I saw but few abroad) owing to the much less power they require. They calculate that one horse power drives 500 mule spindles, but only 200 throstle spindles; and, as the object with them is the greatest possible produce, quality being a secondary consideration, they seldom adopt throstles at all.

In one mill in Gand, where I took an exact account of the produce, I found that each spindle produced 30 decagrammes per 72 hours of No. 30s; that is $\frac{33}{50}$ths of an English lb., equivalent to $19\frac{4}{5}$ hanks per week!

The drum wheel of a Gand cotton mill makes 150 revolutions, whilst with us it would make 130.

Mons. de Bast told me, that they frequently buy their cotton at Liverpool, in order to have a better choice. He complained bitterly of being unable hitherto to obtain a foreign market for their cotton twist, but he relied confidently on doing so when their new machinery was completed, which, he expects, will give an immense impulse to their trade. He believes that our corn laws will continually operate in increasing the facility,

and encouraging the progress, of foreign manufactures. All the continental manufacturers I met with spoke most joyously of the exceedingly small chance the English manufacturers have of getting the corn laws repealed. They speak of the landed interest in England in terms of great affection.

Flax forms one of the main sources of Belgian industry. The two Flanders produce alone, the value of 30,000,000 to 40,000,000 fr. per annum. The damasks of Courtrai, and many other towns, are too widely celebrated to require mention. Of common linen cloth, 750,000 pieces, value about 100,000,000 francs, were sold in 1836 in the different market towns in Belgium.

The spinning of flax by power is engaging the active attention of the Belgian capitalists, as well as of other nations. Mr. Cockerill, the iron king, of Liege, and who engages in nearly every department of industry in existence, has already a very prosperous flax spinning mill at Liege, of which the engine is of 90 horse power. Two more are building at Gand. We have not the same advantages for the purchase of the raw material as we enjoy in the cotton trade. Not only do France and Belgium produce the finest flax within sight of their rising mills, but the river Lys is invaluable for its bleaching qualities. The flax industry, first and last, employs 400,000 persons in Belgium.

Next to the linen, the cloth trade is the most lucrative of the textile manufactures of Belgium.

A capital of at least 80,000,000 is embarked in this branch; and about 14,000,000 are yearly expended in the purchase of foreign wool; the indigenous wool barely reaching a figure of 200,000 francs.

Verviers is the seat of the plain cloth manufacture, in which Mr. Cockerill is said to be much interested; and I saw, when there, another mill of gigantic dimensions, erecting by this individual.

A report from the Chamber of Commerce in 1833, represented the workmen employed there in the cloth manufacture to amount to 40,000; the annual production was calculated at 100,000 pieces of cloth, of a value of nearly 25,000,000 fr., or L.1,000,000 sterling.

In 1812, the trade and population of Verviers amounted to not one-half the present amount. The looms were one-half, but the produce has been tripled.

There is a very large carpet manufacture at Tournai, of 90 looms, where every description of carpeting is made. I was not able to get a sight of it, but I learnt the wages average 3 fr. per day for the good weavers, and 2 fr. 25 cent. for the second class. Seven-eighths of the whole produce are exported. The total length of carpeting produced annually averages 120,000 metres, or about 1,573,333 yards.

Mr. Smith, of Manchester, recently gave the following correct account of the extraordinary cheapness of the Saxon hosiery, which I have been at some pains to verify:—

"Saxony already manufactured as large an amount of cotton hosiery as G. Britain; and she exported 1,500,000 doz. pairs, while our export was only 430,000 pairs. Saxony exported to the United States about as much cotton hosiery as we exported to the whole world; and she not only exported to other foreign countries, but also to Great Britain. He held in his hand a beautiful specimen of Saxon made cotton hosiery, (a white cotton open-worked glove for ladies' wear,) such as he understood could not be made in this country; and for these gloves a hosier in Manchester gave 3s. 6d. per dozen pairs. He exhibited another beautiful specimen of hosiery, a stocking of fo-

reign manufacture, with one of similar quality, but English manufacture. The latter, a hosier at Nottingham told him, was there worth 6s. a dozen pairs; the price of the Saxon article at Hamburg was 3s. 2d. per dozen pairs. He next showed other beautiful specimens of stockings of a better quality, both Saxon and English manufacture; the price of the latter at Nottingham being 23s. a dozen, and of the former at Hamburg 12s 4½d. a dozen. With such facts as these before them, would any gentleman say that foreign competition was a farce? What ought we to say of the corn laws, when the Saxons could make articles at this amazingly low rate, and yet buy their yarn in the same market as the Nottingham manufacturers? The yarn from which these Saxon articles were made was spun in England, and sent out to Hamburg, and thence to Saxony; so that, in going out and returning manufactured to England, there was a carriage incurred for 700 miles, and yet they could undersell us on the very spot where the yarn was spun."

I endeavoured to penetrate the mystery which appears to shroud the cause of our inferiority, in spite of all our efforts, in the production of turkey red dye. The result was a conviction that there is no secret at all. It appears that we buy the drugs, the madder, the aligari, the gall, &c., generally in the same market with the Swiss; that we procure Swiss dyers, Mr. Bam Gardner, and sundry others, to instruct us and superintend the operation, but, nevertheless, we are beaten, and our colours will not "stand" like theirs; neither is the hue so brilliant. It strikes me that both air and water are against us, and that the mystery is much the same as that which renders ale brewed at Burton very different to the ale brewed at Edinburgh, and which would still be different were the same ingredients used at each place.

There is a good deal of dyeing done in Austria. The most beautiful hue of the dyes, in which the Continent excels us, are dyed at Trieste. I beg to call attention to the fact, that though, of course, the exact same materials are used, and the same process followed in other parts of Austria, yet the colour of the Trieste dye is so much and so notoriously finer than others, that it fetches a higher price in the market. This is, of course, owing to some peculiarity in the Trieste air or water, or probably both. Another proof that it is no undiscovered secret that accounts for foreign superiority in these dyes, is the fact, that the dye, even abroad, is never so good in winter as in summer.

The ordinary price of dyeing cotton twist the best colours, is 2 fr. 50 cent., or 2s. per English pound, both in France and Switzerland. Many of the Scotch houses send their yarns to Elberfeld to be dyed.

A young man was sent from a large establishment at Copenhagen to spend two or three years at Erberfield, Mulhause, &c., expressly to perfect himself in that art of dyeing turkey red. Since his return, he has been placed at the head of the dye works at Copenhagen, but has utterly failed in producing a dye of the same durability as those of Prussia and France. He says he is convinced the superiority of the latter dyes is entirely dependent on the peculiarity of the water and climate.

Physical Science.

To the Editor of the Journal of the Franklin Institute.

Account of a Tornado at Mobile, Alabama, on the 24th of March, 1840. *By* S. B. North.

Dear Sir,—However defective the following communication may be, I am in hopes the time and attention bestowed on this subject have not been misplaced. If any satisfactory information will be afforded the Committee on Meteorology of the Franklin Institute, my own gratification will be more promoted than their interests. Yours most sincerely,

Mobile, Alabama. Stephen B. North.

On the 24th of March last, a most destructive tornado passed over the city of Mobile. The day had opened with a clear sky; the weather warm and sultry, with little wind, which changed, about 2 o'clock, P. M., from W. by S. to S. W., when a considerable number of small dark clouds began to collect together in the western horizon in dense masses; and in half an hour, uniting with one common base, ragged in appearance, and here and there protruding out near the centre towards the earth, tapering to an obtuse point, similar to inverted cones. In a short time, these well defined cones were changed at their apex, and became elongated and twisted like a horn. With this exception, there appeared no probability of a change in the atmosphere, or the approach of a storm. Until 5 o'clock, P. M., the wind continually shifted from S.W. to S. by W., when it changed suddenly to W. by N., with increased force—the clouds black and lowering. At 6 o'clock, P. M., we had high wind from N.W., accompanied, for half an hour, with rain, and hail considerably larger than buck shot. The storm then abated for 15 or 20 minutes, after which it came on with renewed vigour, accompanied with hail nearly one inch in diameter; and by 7 o'clock, P. M., we had a hurricane of the greatest violence. The clouds were heaped, in the western horizon, in magnificent sublimity—the lightning flashed vividly, as if the whole atmosphere was overcharged with the electric fluid, and was preparing to unite its power with the other elements, and sweep every thing in its path—the thunder was scarcely to be heard for the wind, which roared furiously, and continued to increase until it blew a tornado.

Of the extent of the track of this storm, we have no positive information, but we believe it extended some distance in the interior of the country, where it was not so destructive in its effects. We, therefore, shall confine ourselves to the destructive influence exerted within the range of our observation, where we are able to appreciate the effects produced with tolerable accuracy.

We have visited and examined the scene of its greatest effects, and find the first impression of the tornado to have been about three miles from the city, in a north-easterly direction, in an open space of several acres, almost entirely cleared of trees. The desolating power of the hurricane may be estimated by the long line of wrecks for about two miles; houses were unroofed and prostrated—fences demolished—trees, of a considerable size, uplifted and overthrown, and others snapped off like reeds. There were several trees, from three to four feet in diameter, perfectly sound, twisted like the strands of a rope, about five feet from the earth, offering no more resistance to their triumphant enemy than reeds before the mower's path. By

measurement, the width of the tornado was 200 yards where it made its first impression, but through the city it gradually decreased to the river, a distance of three to four miles, to about one-fourth of its original width. The course of the tornado, from its supposed place of beginning, was ten degrees N. of W., and to where it terminated it did not vary ten degrees. The current was irregular in its violence, advancing in a succession of terrible gusts, sweeping, by its impetuous force, every thing it encountered in its path. It had an undulating, or wave-like, motion, horizontal with the earth's surface; or in other words, it seemed to have moved in bounds, sometimes receding from and approaching the ground—passing over some tracts, doing comparatively little damage, and then sweeping with renewed violence over others.

The first building the tornado encountered was Mr. Page's saw mill, which was struck at the north-western angle, removing a part of the roof, leaving untouched the remainder of the building. About sixty yards distant from the mill stood Mr. P.'s dwelling, 20 by 45 feet, well and substantially erected about four feet from the ground, upon large blocks of wood. It was entirely demolished, burying his wife, daughter, and son in the ruins, who, by the aid of the neighbours, were immediately extricated; but the life of Mrs. Page was found extinct, and the daughter seriously and the son slightly injured. The house seemed to have been lifted bodily, in an upright position, by the force of the wind, and after the storm had passed, to have fallen in the same position it originally occupied; but every stud, tie, brace, and corner post were separated from each other, and every tenon and mortise broke. The flooring of the house and piazza, with the joists, were all that remained without being separated. We are inclined to believe the destruction of the house may be traced to the rarefaction of the air on the outside of the building, and the explosive force of the air acting on it from within. The kitchen, detached from the main building, and distant only 20 feet, was left untouched by the storm—offering sufficient evidence that that part of the mill destroyed was on the edge of the tornado, the kitchen on the outside of it, and the dwelling in the centre of its effective power.

We predicate our opinion on the width of the tornado from the distance between Mr. Page's kitchen and mill and the trees on the opposite side brought within its effects, which space does not exceed 200 yards. After leaving Mr. Page's, it passed over a tract of about a quarter of a mile, leaving scarcely a trace of its path; then it encountered a knoll, thickly studded with trees, which were all prostrated—those lying in the centre uprooted and overthrown in the path of the storm, and those on the edge not uprooted, were shivered or twisted off at different elevations, leaving only a portion of their shattered trunks standing. We found the trees on either side lying at an angle of 30° towards the centre of the storm, with their tops in the direction of its track. The next point it encountered was the refectory attached to the nunnery, a frame building, 52 by 31 feet, substantially built, and distant about 600 yards from its last effects. It was entirely destroyed, except the roof, which, after the sides had been scattered in every direction, fell on the outside of the foundation, exposing two-thirds of the altar. The pupils had retired from the building a few minutes before the tornado struck it; the Lady Superior with several sisters had remained, and were about sitting down to their evening meal. They were all prostrated by the fallen timber around them, and were covered with the roof, which fell upon the benches, forming a sufficient barrier for their protection, against being

crushed to death. They all escaped without any serious injury. The gable end of a brick kitchen, 20 by 30 feet, attached to the nunnery, was forced out, and some of the bricks carried 150 feet, and other damage was done, but not sufficient to cause it to be entirely rebuilt. After passing over another tract, and continuing in terrible force, removing a portion of the residence of Lewis Judson, overthrowing one of his chimneys, and stables, and doing considerable damage to Mr. Williams' dwelling, tearing his fences and prostrating his trees—after this, its force was materially diminished, and was scarcely felt in the bay below, above the general high wind which had been prevailing.

Throughout the tract of the tornado, we have no evidence of any whirling motion having characterized it.*

M. Lévy on Haydenite and Beaumontite, two minerals from the United States.

M. Lévy, one of the most distinguished crystalographers of Europe, has recently read before the French Academy of Sciences, a notice of Haydenite and of another mineral accompanying it, which proves to be a new species, and which he has named Beaumontite, in honour of M. Elie de Beaumont. The Haydenite was first discovered in a gneiss rock near Baltimore, and was first described as a new species by Prof. Cleaveland in his Mineralogy, second edition, 1822. Although it has never been analyzed, it is a little singular that his high authority has been totally disregarded by the authors of later treatises on mineralogy in this country, who have classed it with chabasie. This is the case with Shepard and Dana. The latter erred, also, in saying that the mineral was found in trap rock; and M. Lévy does not seem aware that Dana has comprehended it within the species chabasie, mentioning the locality, and giving it a place, without any question as to its character, or even acknowledging it as a new variety of that mineral. We must now, however, give up to the high authority of M. Lévy, whose nice examination of its characters, and determination of its crystaline form, (incompatible with chabasie) fully establishes its claim to a new species. The opinion of Brooke, that the mineral in question was Heulandite, we can reconcile with the discovery of M. Lévy, only by supposing the pearly white crystals which accompany the specimens, to have been mistaken by him for the mineral called Haydenite by Cleaveland, and especially as they have been regarded as Heulandite in this country. This mistake would be quite natural if he had not Cleaveland's description before him as a guide; at any rate, we know Mr. Brooke's accuracy too well to believe that he would ever have mistaken the genuine Haydenite for Heulandite, after the slightest examination.

All that is now wanted to complete the natural historical description of this mineral, and the pearly crystals above alluded to (Beaumontite) associated with it, and to assign them a place in the systems, is an accurate analysis, which we hope we may have the pleasure of recording at no distant period. Dr. Hayden will, probably, be able to supply enough of both minerals for this purpose. We subjoin the following abstract of M. Lévy's remarks from the London and Edinburg Philosophical Magazine for Feb., 1840, p. 156:—

* We would query of our correspondent whether the fact of large trees having been twisted like a rope, is not an evidence of a whirling motion. G.

"The authors who have mentioned this substance have merely repeated what has been stated by Cleaveland. Mr. Brooke, in his article on Mineralogy in the Encyclopædia Metropolitana, classes, without assigning any reason, Haydenite with Heulandite. I will add what appears to me singular, which is, that in a work recently published in the United States, entitled a System of Mineralogy, by James D. Dana, and printed at New Haven in 1837, no mention is made of this species, though in other respects the work appears to be pretty complete.

"The cause of our ignorance respecting the nature of Haydenite may be explained by the small number of specimens which have been brought to Europe. M. Lévy then goes on to state that he had seen only three specimens of Haydenite, and the account he gives of it is as follows:—Haydenite is regularly crystalized: the crystals have the form of a small oblique prism with rhombic bases, in which the incidence of the lateral faces is 98° 22′, and the incidence of the base, on each of the lateral faces, is 96° 5′. The crystals are frequently macled. The axis of revolution, around which one of the two crystals forming the macle is supposed to have turned 180°, is perpendicular to the base of the primitive form, and the face by which the two crystals are united is parallel to the same base. The crystals are thickly grouped together, and a small portion only of each is isolated. I have observed no modification either upon the edges or angles, so that the relation between the sides of the base and the lateral edges remains undetermined. The crystals cleave with the same facility on every face of the primary form. The cleavage faces sometimes present an uneven surface on account of small dark spots, as if the substance had suffered incipient decomposition. The crystals are usually covered by a thin layer of hydrate of iron, which is readily detached by the knife, and the faces of the crystals thus exposed are sufficiently brilliant to be measured by the reflective goniometer. The colour of Haydenite is brownish yellow, or greenish yellow; the crystals are translucent and sometimes transparent, they are easily scratched by the knife, readily friable; the hardness is nearly the same as that of fluor spar. The quantity detached was too small to admit of its specific gravity being taken."

Beaumontite, a new Mineral.

"This interesting substance accompanies the Haydenite above described, occurring in small brilliant crystals of a pearly lustre. Their form is that of a prism with square bases, terminated by obtuse pyramids. The summits of all the crystals are closely grouped. The incidences of the faces of the terminal pyramids, measured with Wollaston's goniometer, are 132° 20′ of the two faces, the intersection of which is parallel to one of the edges of the base of the primary form, and 147° 18′ of the two faces above, whose intersection is inclined to this base. One of these angles is a necessary consequence of the other. By calculating from the first, the second is 147° 28′ instead of 147° 18′, as determined by experiment. The primary form of the Beaumontite may therefore be taken as a right prism with square bases, in which the relation between the sides of the base and the height is nearly as the numbers 23 and 10, and then the faces of the pyramid have b^1 as a crystalographical sign. The crystals cleave readily parallel to the lateral faces of the primary form, but more easily parallel to one of the faces than the other, and this greater facility corresponds with the pearly

lustre peculiar to them. There are also some indications of cleavage, parallel to the diagonal planes of the primary form, the crystalographical sign of which is g^1. The colour of the crystals is whitish yellow; they are translucent; their hardness is greater than that of Haydenite, and is almost equal to that of phosphate of lime.

"The crystals of Beaumontite and Haydenite form a crystaline layer, the brilliant portions of which belong to the first mentioned substance, and the parts covered with brownish hydrate of iron to the second. This layer covers a granular rock, composed principally of grains of quartz and Haydenite. The other face of the specimen is covered with small flat elongated prisms of green amphibole."

Bibliographical Notice.

The American Journal of Science and Arts.

This excellent periodical continues to be supported not only with undiminished vigour, but with an increasing amount of original and enriching communications from the gifted friends of science in our country. It has now acquired a veteran constitution, and is destined, we hope, to transmit to very distant ages, the fruits of American ingenuity, research, and discovery. It has not only gained, within the twenty-one years of its existence, an American and European, but, as far as the English language has been made the vehicle of knowledge, a cosmopolitan reputation. Its track of usefulness differs so materially and essentially from that of our own periodical, that we feel no other rivalship than those of good wishes and the most friendly desires for a permanent prosperity. Among the original articles, the most readable and agreeable in the last (July) Number, is one from the pen of the senior editor, Professor Silliman, on phrenology, containing the substance of his remarks at a meeting held for the purpose of offering complimentary resolutions to George Combe, Esq., at the conclusion of his course of lectures at New Haven in March last. Although we are still doubtful of the claims of phrenology to the place of a sisterhood among the *Sciences*, we are much pleased with the exhibition now made of the physiological analogies which may be advanced in defence of its rank and pretensions, as an object well worthy of popular illustration, and of the study of accurate observers. G.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1839,

With Remarks and Exemplifications by the Editor.

1. For *Dressing Mill Stones;* Shadrach Trumbull, Suffield, Hartford county, Connecticut, August 2.

The machine which is the subject of this patent is said to be applicable to the dressing, or pecking, of mill stones, and also to stones of other descriptions.

A round peck staff is prepared so as to have a steel chisel affixed in one end, and this staff is made to work up and down by hand in a stock, or slide, through which passes a guide rod, along which the stock may be moved

back and forth, horizontally. By means of another guide rod, the stock, with its peck staff, may be made to stand either vertically or obliquely. The whole apparatus is to be fixed on a platform, upon which the operator is to stand when using the instrument; and when this is so placed that the chisel will stand directly over, and the guide rod in, the line of, a furrow, the peck staff is to be worked up and down by hand. The claim is to "the combination of the ways, or rods, the stock, fork, and peck staff, or handle, as described."

The fact is, that there is but very little novelty in this machine; mill stones have been dressed by similar machines, in which the chisel was directed along the furrows by guide rods, although under an arrangement different from that above claimed.

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2. For a *Counterblast for Blacksmiths' Fires;* William Sharp and Heman W. Sharp, Catherine, Chemung county, New York, August 2.

The wind from the bellows is to be blown into a wind-chest, from which two pipes are to proceed, leading to opposite sides of the fire. A valve, or sliding shutter, is made to divide the wind-chest into two parts between the two pipes leading to the fire, so that the blast may pass either through one or both of these pipes at pleasure. It is stated that the double blast has been before used, and is not, therefore, claimed; but the claim is confined to the manner of governing the blast by directing it through one or both pipes, as may be desired.

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3. For a machine for *Packing Flour;* James Banta, Utica, Oneida county, New York, August 2.

There is, we think, much novelty in the piston of this flour packing machine. Said piston consists of a hoop, of the proper size to enter a flour barrel, and the circular disk within this hoop consists of six, or any other convenient number of, valves, or shutters, which fill up the space between the hoop and the centre, they are hinged by one edge to the hoop, and to the piston rod in the centre, opening downwards, and when closed constitute a flat piston. The piston rod receives a rotary motion, and is also worked up and down by means of a crank, during the time of packing. When this operation is to be commenced, the piston is allowed to descend to the bottom of the barrel which is to be packed; a quantity of flour is then put in above the piston; the rising of this allows the valves to open and the flour to fall through, whilst by its descent and revolving motion, the flour is packed; the operation being continued until the barrel is filled. The piston rod and its appendages are contained within a frame, that slides vertically within an exterior frame, or guide posts, and this interior frame is allowed to descend at every stroke of the piston.

The claim is to "the mode herein described of packing flour by means of the piston head with valves, and having a vertical reciprocating and horizontal rotary motion, all as herein described." We see no reason why this plan should not succeed well, provided there is not a tendency in the valves to clog, and with a dry article, like flour, this, probably, will not be the case.

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4. For a machine for *Splitting Leather;* Horace White, Binghampton, Broome county, New York, August 2.

There is a large number of leather splitting machines, most of which ope-

rate upon the same general principle, the claims set forth by their improvers being to certain special devices invented by them. The claim, in the present case, is to "the manner of combining the cylinder with the knife, or cutter, by bringing the knife near to the cylinder, so that as it revolves, the leather shall be carried by it against the knife; and regulating the knife by means of screws, so that it shall, in combination with the cylinder, gauge the thickness of the leather to be cut."

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5. For a *Rotary Steam Engine*; John Drummond, Elizabethtown, Essex county, New Jersey, August 3.

After a description of considerable length, the patentee limits his claim "to the mode of attaching the revolving head, or piston, to the rotary shaft, by means of an arm of the form described." It is acknowledged, therefore, that the novelty is but small, and as in a good rotary engine the novelty must be very great, we shall not occupy the time and space necessary to particularize the mode of fastening above claimed.

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6. For a *Cattle Pump:* Andrew Bailey, Jefferson, Ashtabula county, Ohio, August 3.

We have often remarked, that when we meet with a proposed improvement on pumps, we anticipate but little, as the requisites to a good instrument of this kind are well understood, and well supplied. It frequently happens, therefore, that the proposed improvement manifests a want of knowledge on the principles of hydraulics, and of an acquaintance with what has been practically effected. Among the various schemes which have been proposed, that now placed before us is one of the most absurd, as it presents a very troublesome mode of arriving at sure defeat. A cylinder, twenty-eight inches in diameter, and a foot deep, is to be placed in the reservoir from which the water is to be raised; this cylinder, or tub, has a bottom furnished with a valve opening upwards, to admit water. A piston is to be made of wood, two inches thick, which, when leathered, is to fit the cylinder. To this is to be attached a hollow tube which is to constitute the piston rod, and through this tube the water is to rise. The piston is to be forced down by causing an animal to ascend an inclined plane, or platform, bearing on the piston rod, and when said animal retires, the piston is to be raised by means of a weight passing over a pulley. In the tubular piston rod there is a valve opening upwards; the water is to flow into a trough.

The claim is to "the hollow piston rod in combination with the trough, platform, and the piston, cylinder, and valves, of the ordinary pump."

This will be a most effectual mode of applying the principle of the hydrostatic paradox to the bursting of the cylinder, or tub, or rather to the destroying of the twenty-eight inch piston of two inches in thickness, and to the forcing out of much more water round its packing than will find its way through the hollow piston rod.

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7. For an improvement in *Piano Fortes:* William Cumston, Boston, Massachusetts, August 3.

The object of this improvement is to stop the vibration of one of two strings, in instruments having two unisons to each note, without the lateral shifting of the hammers, and this is to be done by causing wedges, or mutes, attached to a bar, to descend between the strings of each note.

The claim is, first. "The checking of the vibrations of the strings by the

interposition of wedges, or mutes, between them, the wedges being arranged on a beam, as described. Second. I claim a beam made to descend by its own weight, by being loaded, or constructed of metal. Third. I claim the arrangement of the arms and levers, which, in combination with the lever pedal, produce the descent of the beam."

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8. For a machine for *Sizing Paper:* William W. Wilson, and Chas. Dickerman, Westfield, Hampden county, Massachusetts, August 3.

This machine is for dipping paper in the sheet into a circular tub, or vat, containing the sizing liquor. Instead of dipping it by hand, the paper is to be held in clamps at the lower end of slides set round, and carried by the revolution of a vertical shaft, said slides having counter weights attached to cords passing over pulleys.

"In using this machine, the workman employed in sizing the paper may dip all the respective portions successively without moving from his station, by merely causing the shaft and its appendages to revolve, in consequence of which arrangement a much larger quantity of work may be performed than by the ordinary apparatus."

The claim is to "the placing of such slides in such a manner as that they may be carried round by a revolving shaft in an apparatus constructed substantially in the manner and for the purpose set forth."

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9. For improvements in a machine for *Pricking Leather, preparatory to Stitching;* Samuel Sheldon, Cincinnati, Ohio, August 3.

A machine bearing considerable resemblance to that which is the subject of the above patent, had been in use, but the patentee has made certain improvements in the arrangement of its parts, by which it is rendered more convenient in use; these are represented in the drawing, and claimed by reference thereto.

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10. For an improved *Portable Soda Water Fountain;* Samuel B. White, Cincinnati, Ohio, August 9.

This patent is taken for using with a portable soda water fountain a large stopper which screws into its upper side; this stopper has a chamber within it for containing the exact quantity of the powder intended to be dropped into the vessel for producing the effervescing mixture, which powder falls by the pressing down of a rod. The claim is to the particular arrangement of the parts of this stopper.

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11. For *Window Blinds;* Alonzo S. Grenville, and Thomas J. Lewis, Cambridge, Middlesex county, Massachusetts, August 9.

The claim under this patent is to "the method of opening and closing blinds by means of the combination of pullies, cords, and sliding blinds, in the manner described."

These blinds are called railway blinds, as they are to run on wheels, or pulleys, in the manner of sliding sashes. There are to be pullies in the window frames, around which cords pass from the interior of the room, and which are attached to the blinds on the outside of the window; by this arrangement the blinds can be opened and closed without opening the window.

12. For a machine for *Cleaning Wheat,* &c.; Thomas M'Crea, Anne Arundel county, Maryland, August 9.

This machine consists, principally, of two circular cast iron plates, having teeth on their faces; one of them forms a horizontal bed, and the other revolves above in the manner of a mill stone. The claim is to "the method of arranging the teeth of the two cast iron circular plates so that the teeth of the upper plate shall revolve between those of the lower plate."

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13. For a *Cooking Stove*; Elihu Smith, Troy, Rensellaer county, N. York, August 9.

The claim under this patent is to "the attaching a stove, or portable oven, having a grate under it, in which a separate fire may be made whenever necessary, to a cooking stove as herein described, so that both, when combined, shall form a cooking apparatus, in which either fire place may be used as occasion requires. Also the movable compound grate, as described in connexion with the cooking apartment of the stove, by means of which the capacity of the grate for holding coal is enlarged, and the plates of the fire place in a manner protected from the action of the fire; also the movable grate as described, in connexion with what I have termed the fire apartment," &c.

The particular arrangements above referred to are shown in a number of figures, and described at considerable length, but cannot be readily made known by description only.

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14. For a machine for *Washing Clothes;* I. Leavitt, Adnah Gilmore, and William Sturdevant, Turner, Oxford county, Maine, August 9.

The claim is to "the combination of two fluted cylinders with the concave bed of rollers on which they act, and also the combination of the rocker with the bed of rollers, as described."

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15. For a machine for *Shelling Corn*; Lester E. Denison, Saybrook, Middlesex county, Connecticut, August 12.

The specification of this patent is of considerable length, and the construction is such as to require the aid of the drawings for its explanation. The claims are to a "shelling cylinder placed within, and in combination with, the revolving, concentric, cylindrical rest and the segment concave. Also the revolving concentric cylindrical rest, constructed in the manner described."

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16. For *Sawing Staves;* Royal E. House, Choconut, Susquehanna county, Pennsylvania, August 12.

In this machine the saws are to be bent so as to adapt them to the curvature to be given to the staves transversely, and it is so constructed as to admit of staves of different curvatures being cut on the same machine.

A shaft is placed horizontally with journals resting on suitable bearings. This shaft carries two bars, or arms, of metal, which stand out from it at right angles, parallel to each other. These arms must be of a length sufficient to carry the saws for cutting hogshead staves. To one of them is attached a shackle bar, operated by a crank, so as to give them a vibratory motion. Upon these arms are placed clamps which are to hold the ends of the saws, and these clamps may be placed at any required distance from the shaft. For a vessel eighteen inches in diameter, they would be placed

at the distance of nine inches, and the ends of the saws confined in them by means of jaws fastened by screws. Two saws being so placed, form, with the clamps, a circle of eighteen inches in diameter. Suitable carriages are to be used for feeding the bolts, or stuff to be sawed, up to the machine.

The claim is to "the sliding saw clamps, changing the diameter of the saws to suit the work required; and the scales on the beams to graduate the position of the saw clamps, as described."

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17. For a *Pump*; James Pike and William Fisk, Cumberland, Rhode Island, August 13.

"The principal improvements which we have made are intended to facilitate the supply of water through the lower valve, and to provide a more convenient way of letting off the water, by opening both the valves, than has hitherto been attained, in order to prevent its becoming frozen in the pump in cold weather."

The lower part of the chamber of this pump, which contains the lower valve, is enlarged, say to double the diameter of that part in which the piston works, giving an opportunity of making the valve openings larger than ordinary, and also making room for the apparatus by which the lower valve is to be raised for letting out the water, which is effected by raising the pump brake higher than it is raised for pumping, thus bringing a rod attached to the piston into contact with a lever that raises the lower valve, and, by a similar operation, raising the upper valve: the arrangement is simple, and must be effective. The patentees do not claim to be the first to have invented a mode of opening the two valves, but claim their "mode of effecting this object, that is to say, the manner in which we have constructed and combined the sliding valve, its rod, and lower piston plate, with its shank, or rod, so as to act upon the lever, and raise the two valves simultaneously, as set forth; also, the forming of the enlarged chamber for the purpose of containing the lower valve, increasing the water way, and admitting the apparatus concerned in the opening of the valves, as described."

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18. For machinery for *Drying Grain and Seeds;* Richard Else, Great Britain, August 14.

"The peculiar feature of novelty, or improvement, which I claim to have invented in apparatus or machinery for drying corn, grain, or seeds, is the lanthorn, or skeleton cylinder or drum, covered with wire work, or reticulated fabric, and having reticulated ledges for turning over the corn, grain, or seeds, and allowing the steam evolved during the operation of drying to escape freely; whether the said drum be made perfectly cylindrical or polygonal, and whether covered with wire gauze or perforated plates of metal, or other material, and in whatever manner the same may be mounted and made to revolve, provided the same be made available to the purpose of drying grain, or seeds." The drum containing the seeds is to be placed, and made to revolve within, a suitable stove, properly heated. The ledges spoken of extend from end to end of the drum, and are composed of double perforated plates, or reticulated laminae, standing at an inch or two apart, and extending to a considerable distance from the surface towards the centre, by which the position of the grain is constantly changed, and a large evaporating surface obtained.

19. For an improvement in *Stoves*; Judson B. Galpin, New Haven, Connecticut, August 14.

This improvement is a device for increasing the radiating surface; and for that purpose two flat pipes are made and convoluted so as to resemble the scroll of an Ionic capital, and these are so placed, on each side of the stove, as that the draught shall pass through them and escape through pipes connected with the inner end of each convolute. The claim is to "the convoluted pipe, or pipes, combined with the stove and horizontal drum, or with the stove alone, substantially in the manner set forth."

These pipes will be troublesome to make, and when made, they will inevitably collect a quantity of dust which it will not be easy to remove; moreover, there will be but little advantage resulting from them, as their main radiating surfaces will be opposite, and near to each other, and the rays of heat will not, therefore, be directed into the room.

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20. For an improved machine for *Punching Metals;* Samuel H. Brown, Wheeling, Ohio county, Virginia, August 14.

In this machine, the punch is to be forced down by the raising of one end of the lever, on which it is fixed, by the action of a cam; this cam is made to operate upon a system of friction rollers, to lessen the friction, and the claim made is to "the arrangement of the rollers, in combination with the cam lever; that is to say, placing the two rollers on which the cam acts, in a box or carriage, which travels on another set of rollers, in the manner described."

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21. For a *Machine for Propelling Machinery;* Ammi West, Greene, Kennebec county, Maine, August 16.

The title of this patent induced a suspicion that the machine which is the subject of it, would not prove to be a valuable present to the useful arts, and an examination of the specification and drawings has fully confirmed this impression. The most direct and simple mode of applying power is usually the best, and that before us contains an array of levers, ratchets, endless chains, &c. &c., through the intermedium of which the power of a man is to be applied to propel other machinery, and that in the manner of the tread mill. There are two treadles upon which the man is to stand, and which he is to depress alternately. From each of these treadles rises a pitman, the upper end of which has a hook upon it. The hooks of these pitmen are to catch upon the joint bolts of two endless chains, passing round chain wheels, by the axes of which wheels the other parts of the machine are to be driven. The claim is to "the employment of endless chains in combination with the dogs and treadles, as a substitute for ratchet wheels heretofore employed," &c. The whole thing is unworthy of further remark; and if one such machine has been made and tried, it stands self condemned.

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22. For a *Molasses Gate;* Jonathan D. Kellogg, and Justus Wright, Northampton, Hampshire county, Massachusetts, August 16.

This molasses gate is constructed much like the common cock, having a conical pin turning within a socket, in the ordinary manner; instead of a hole, or mortise, through this pin, it is cut entirely away on one side, so as to leave an enlarged way for the flow of the molasses. The socket has no nose attached to it, for the delivery of the liquid, but has a hole in it for the fluid to pass through. The claim is to "the rotary valve in combination

with the hollow cylinder, or truncated cone, as described." Were we to speak phrenologically, we should say "novelty small."

23. For an improved *Ever-pointed Pencil Case*; John Hague, city of New York, August 16.

In this pencil case, the pencil is to be protruded by the sliding of an outside tube, which covers the slot on the tube within it, and the claim is to "the mode of protruding the point by a middle outside tube, the whole constructed and operating as set forth;" the precise arrangement would require the drawings for its illustration.

24. For a *Spark Arrester*; Henry Wilton, Wrightsville, York county, Pennsylvania, August 17.

The general principle upon which this spark arrester is constructed is the same with several which have preceded it, but with some variations and additions in the combination. The smoke flue is to be surrounded by a casing, leaving a space between the two for the reception of sparks. The cap is to be covered with wire gauze in the usual manner, and in front of it there is to be a funnel-formed opening, to collect the wind which is to drive the sparks back into a conductor leading down to the space between the flue and its case. At the lower part of the chimney there is to be another funnel-formed opening leading into the flue, and, of course, crossing the space between it and the case; this is said to be for increasing the draught of the chimney, which we apprehend it will fail to effect.

The claim is to "the combination of the funnels, prism, and conductor with the ordinary flues, cap, and wire gauze, for preventing the escape of sparks at the top of the chimney; also the funnel in the inner flue for increasing the draught."

25. For *Furnaces for Smiths*; Edward Nichols, Hampden, and James Augur, New Haven, New Haven county, Connecticut, August 21.

This is more properly a forge than a furnace, and is particularly intended for the burning of anthracite. In its construction it differs but little from such as have been before used. It consists of the chamber for containing the coal, and a wind chamber below this, into which the blast is to be blown. The whole is to be made of cast iron, and the fire chamber is to be lined with fire brick; at the lower part of this there is a drop grate, by which the coals are allowed to fall into the wind chamber, and from this they are discharged by a close fitting door. This door forms the bottom of the wind chest, and is connected to the drop grate by a jointed rod, in such manner as that the lowering of the door causes the drop grate also to descend.

The claim is to "the manner in which the drop door is combined with the grate; by which, when the door is opened, the grate is let down."

26. For improvements in *Railroad Switches*; John C. Post, Morrisville, Bucks county, Pennsylvania, August 21.

"The nature of this invention and improvement consists in a certain combination and arrangement of connecting rods, cranks, wrists, crank-shafts, and movable rails at the turnouts, added to and combined with the ordinary switches; and likewise certain additional wheels suspended to the locomotive by swivels, cranes, or otherwise, for depressing the movable rails at pleasure for shifting said switches."

The claim made is to the particular combination of the respective parts above referred to, and it will be readily apprehended, from the enumeration, that we cannot attempt to give a verbal explanation of the proposed system in our monthly list.

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27. For a *Rotary Steam Engine and Pump;* William H. Baker, and Samuel H. Baldwin, Cohoes, Albany county, N. York, August 21.

This instrument, which is to be used either as a rotary steam engine, or as a pump, is to operate in the same way with such as have been before essayed. Two cylindrical segments are to revolve within a case having concave ends exactly adapted to them; each segment is about a semi-cylinder, and on its axis is another semi-cylinder of half its diameter. By gearing upon the axles, on the outside of the case, these segments are made to revolve with equal velocities, and in such manner as that the larger cylindrical segment of one has its face in contact with the smaller segment on its fellow. So far the plan is old; the claims point to what are esteemed the novelties in the improved construction, and these are to "the mode of keeping the joint tight between the segment pistons as they revolve, by means of the segment or cam gearing on the axles of the segment pistons, which gives to the pistons equal velocities as they revolve; and to the arrangement of the parallel metallic packing against which the segment pistons revolve, regulated by screws from the outside of the chamber, in combination with the hemp packing at the sides of said metallic packing, as described."

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28. For a machine for *Bending Tire*; Aaron Whitcomb, Choconut, Susquehanna county, Pennsylvania, August 21.

"The nature of this invention consists in arranging a lever between two short posts, erected in a strong bench, or block, whose fulcrum is a strong bolt passing horizontally through said lever and posts, and in having a segment block, a segment of the circle to which the tire is to be bent, secured to the under side of the lever, immediately below the fulcrum of the same, and in having a loose clevis attached to the shorter end of the lever by a horizontal pin passing through the clevis and lever, which clevis holds the tire against the surface of the segment." The claim is to "the method described of bending tire by means of the segment block, in combination with the lever and clevis, as described."

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29. For a *Dovetailing Machine;* Ari Davis, Boston, Massachusetts, August 21.

This is an ingeniously contrived, and a well operating, machine for making dovetailed tongues and grooves on the ends of boards, for forming boxes, and other articles requiring to be similarly jointed together. The joints are to be mitre joints, and upon one of the boards the mitre is formed with a dovetail groove along it, and upon its corresponding piece, a dovetail tongue. These mitres, tongues, and grooves, are cut by circular saws fixed upon movable standards, in such a way as to be capable of exact adjustment. The claim is to the described manner of constructing this apparatus so as to cut the mitre, and the tongue, or groove, at the same time.

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30. For a machine for *Ventilating Rooms;* James M. Burton, Salem, Clarke county, Georgia, August 17.

This ventilator, or rather blowing machine, consists of two inverted vessels, dipping into water, in the manner of gasometers. These are furnished with valves to let air into them as they rise, said air escaping through tubes, leading to the apartment to be ventilated. The air vessels are to be worked up and down alternately, by means of geared machinery, to be propelled by a weight, all of which is of the ordinary character of such machinery. The claim is to the bellows, water vessels, and tubes, constructed and operating as described. Should either novelty or utility in the machine be inquired after, we, at least, should be at a loss to point it out.

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31. For a *Bridle Bit;* Dan. S. Balch, Bradford, Orange county, Vermont, August 23.

"The nature of my invention consists in a revolving spool, with deep collars upon the ordinary bit, for reducing friction, or rubbing, against the mouth of the animal."

An iron wire, or rod, about a quarter of an inch in diameter, passes through the tubular perforation in an iron spool, which spool is about five inches and a half long, and about five-eighths of an inch in diameter; its two ends are formed like the ends of a spool, used in cotton spinning machines. Each extremity of the centre wire is bent so as to form an eye, and receives a ring, in the ordinary manner. The claim is to "the combination of the wire bit and revolving spool, constructed as described; reducing the friction of the bit against the mouth of the animal to which it is applied." In what way it is to operate to reduce friction we are not told, and it certainly is not very obvious.

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32. For improvements in *Manufacturing Soap;* Arthur Dunn, Great Britain, March 23.

(See Specification.)

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33. For an improved *Screw Wrench;* Henry W. Hewett, Troy, Renssalaer county, New York, August 24.

CLAIM. "I do not claim as my invention the sliding jaw moved by a screw and nut, as this has been known; but what I do claim as my invention is the employment of the parallel bars with their lower faces beveled for the purpose of embracing the sliding jaw, of the form above described, and also the arrangement of the handle, nut, and screw on the other end of the handle, and passing the stem and screw of the sliding jaw between the parallel bars, and through the handle and nut, thereby strengthening the handle, all as herein described."

The sliding bar consists of two parallel bars, leaving a space between them about equal to their own thickness. The two inner edges of the lower side of this bar are champhered, so as, together, to form a dovetail; the sliding jaw occupies the space between these bars, and is widened out so as to fit the dovetail. The movable jaw is acted upon by turning the handle. The whole affair appears to have been well conceived, and the construction is such as to render it convenient and permanent.

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34. For a *Cooking Stove;* James Devine, Rochester, Genessee county, New York, August 24.

"The nature of my invention consists in raising the oven, which is in the centre, and over the fire, between two rows of boilers, so as to have them

directly over the blaze of the fire, and also interposing the dampers between the two plates of iron that separate the oven from the fire, so as to form a third plate, and thus protect the bottom of the oven from a too intense heat; and distributing and equalizing the heat over the oven by means of two dampers placed over the oven." This stove is peculiar in its form. The lower part of it is of the proper width for the fire place, immediately over which the oven extends from front to back, projecting up above the other portions of the stove, like a muffle, or wagon top. The boiler plates extend out as wings along the sides of the oven, the fire chamber curving out to make room for the cooking vessels. The claim is to this particular arrangement, and to that of the dampers.

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35. For an improved method of *Making Sulphuric Acid*; James Hargraves, Paterson, Passaic county, New Jersey, August 24.

(See Specification.)

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36. For improvements in *Fire Arms;* Samuel Colt, Paterson, Passaic county, New Jersey, August 29.

The guns and rifles made upon the plan invented by Mr. Colt, are very extensively known. The present patent is obtained for various improvements in their construction, which we cannot make subjects of description, nor would the claims, without the numerous drawings, be of any value in furnishing a knowledge of the different improvements; we shall, therefore, pass the whole over.

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37. For a machine for *Drilling Metals, &c.*; Elisha Hall, Byron, Genessee county, New York, August 24.

The claim made under this patent is to "the mode of forcing and drawing out the drill; that is to say, the having the drill stock embraced by a hollow cylinder, with a screw cut upon its outer surface, and supported at each end by a puppet in which it works, all as described."

A patent for a drilling machine was granted to William Ray Jones, of Granville, New York, on the 11th of January, 1836, which, from a model restored to the office, appears to be the same in principle, and nearly identical in construction, with that of Mr. Hall. The papers relating to this patent were burnt in the office, and it has not been restored for record, or probably the claim of Mr. Hall would have been rejected.

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38. For a machine for *Cutting Sausage Meat*; G. D. Mettetal, Pittsburgh, Pennsylvania, August 24.

This machine consists, mainly, of a cylindrical body revolving within a hollow cylinder, and carrying leaves, or wings, placed obliquely, which force the meat to be cut against rows of knives, and at the same time carry it from the feeding, to the delivery, end of the machine. The principal novelty in this machine is the manner of affixing the knives, which are confined in place by wedges, similar to those used for plane irons, and this mode of fastening is claimed, as is also a device for shortening the machine by means of two plates of metal, which, when put in place, fit against the revolving cylinder and the interior of the cylindrical case.

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39. For an improvement in *Water Wheels;* Thomas Ruble, St. Mary's, Adams county, Indiana, August 29.

The water wheel here referred to is of the horizontal, reaction, kind, and the improvement claimed is "a curved shoot in combination with a straight shoot;" a device which we apprehend will leave the action of the wheel unaltered, or rather unimproved, and is not, therefore, in our opinion, worth the trouble of explanation and discussion.

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40. For *Water-proofing and Napping Cloth*; William K. Phipps, Framingham, Middlesex county, Massachusetts, August 31.
(See specification.)

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41. For *Supplying Ink to the Pens of Ruling Machines*; Lewis Edwards, Norwich, New London county, Connecticut, August 31.

The ink is to be contained in a trough extending along at the heads of the pens, and into this trough one edge of a piece of cloth is to dip, whilst the other portion of the cloth lies upon the pens, and supplies them with ink, by capillary attraction. Lines may be ruled with differently coloured inks, at the same time with the ordinary lines, by means of small cups of coloured ink placed within the trough, and having a strip of cloth leading from it to the pen, or pens, to be supplied. The claims are to this particular mode of giving the supply.

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42. For an improvement in the *Wicket Gates of Canal Locks;* William L. Potter, Clifton, Park, Saratoga county, New York, August 31.

The wicket gates are to be double, each part consisting of a plate of cast iron, or other material, of sufficient length to extend nearly from side to side of the lock gate, and wide enough, when placed together, to cover an opening in the lock gate sufficiently large for the discharge of the water. These two wicket gates, when closed, form a parallelogram, divided by the line of their junction into two parts, which are nearly triangular, having one end much narrower than the other; these both work on joint pins at their narrow ends, their wider ends sliding in guide grooves. When opened, the lower section of said wicket is to be depressed, and the upper section raised, which is effected by two connecting rods, jointed at their lower ends to the wide ends of the wickets, and at their upper to a horizontal vibrating lever, having its fulcrum at the upper end of the lock gate. The claim is to "the combination of the two wickets, in the manner and for the purpose described."

Specifications of American Patents.

Specification of a patent for Wire Tiller Ropes. Granted to Isaac M'Cord, *Harrisburg, Dauphin county, Pennsylvania, July* 6, 1839.

To all whom it may concern: Be it known, that I, Isaac M'Cord, of the borough of Harrisburg, in the state of Pennsylvania, have invented a new and improved manner of manufacturing round, flexible, wire rope, which may be employed as tiller rope in the steering of vessels, and for other purposes where such flexible rope may be required; and I do hereby declare that the following is a full and exact description thereof.

For the purpose of making wire rope suitable for tiller rope, I take iron wire of the size of from No. 27 to No. 30, selecting that of the best quality, and this I anneal in a covered vessel, to protect it from the action of the atmosphere, in the usual way of conducting that process. I have, at the same time, prepared a suitable vessel containing train oil, which I heat to a temperature of from 200 to 300 degrees of Fahrenheit's scale, and when the iron has been brought to a red heat, I immerse it in the heated train oil, and suffer it to cool in that situation; the effect of this process is to give to each of the wires a complete coating of bright tenacious varnish, which not only protects it from rust, but gives it much greater flexibility than is possessed by iron wire prepared in any other known way. I have essayed flax-seed, and other oils, in the same way, without attaining the same end in an equal degree.

In converting the wire thus prepared into tiller rope, I take about sixty wires of the requisite length, usually from two to three hundred feet, and extend them out into a straight line, giving them an equal degree of tension. This constitutes one strand of rope. I take three such strands and attach them to a hook on a machine similar to that for laying hemp rope, and I also employ a "top," or grooved frustrum of a cone, for laying my wire rope, in a manner similar to that of laying hemp rope. But it is a point of great importance in the manufacturing of round wire rope, that there be no twist whatever in the separate strands, and such twist would be given to them in the ordinary process of laying; to prevent this, I connect each of the strands at their ends opposite to that where the laying commences, to three separate hooks on a wheel or apparatus used for twisting and laying ropes, and which is well known, and by means of this I give a countertwist to the strands during the whole operation of laying, to such extent as shall keep the wires in each strand in a straight line, or parallel to each other, continuing the operation until the laying is completed

I have mentioned the using of three strands for making my rope, but a larger number may be used if preferred. A rope of four strands will be more perfectly round than one of three, but from the same quantity of material, the latter will have the greatest strength.

Having thus fully described the manner in which I manufacture my round flexible, wire rope, what I claim as my invention, and desire to secure by letters patent, is the employment of the heated train oil in the process of annealing and coating the wire in the manner above set forth; and also the keeping of the wires of each strand without twist in the operation of laying, by giving to them a countertwist, as above described.

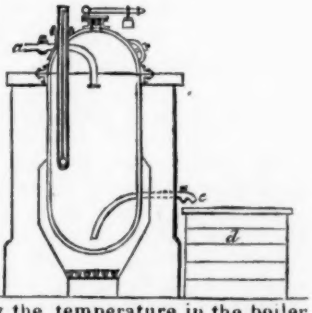
ISAAC M'CORD.

Specification of a patent for improvements in the Manufacturing of Soap. Granted to ARTHUR DUNN, *of Great Britain, March* 23, 1839.

This invention consists, first, with reference to soaps generally, in boiling or heating the ingredients of which they are to be composed or manufactured, in close or covered steam-tight vessels, so that the saponifying process may be performed under steam pressure, and at temperatures exceeding the ordinary boiling points of the aforesaid ingredients, when they are mixed together and exposed to heat in open vessels, in the ordinary process of soap boiling; and secondly, with reference to those soaps in particular, of which silica is to form a component part, my invention consists in placing

silica, or materials containing silica, in the high pressure boiler with the other ingredients, as hereinafter stated, or in dissolving silica with caustic alkaline lees in a steam-tight vessel or digester, at a high temperature and under steam pressure, and thus producing a silicate which may be mixed afterwards with the ingredients hereinbefore alluded to, (when required to make silica soap) as hereinafter described; and, whereas, the manner in which my said invention is to be performed is as follows:—

I take the ingredients for making soap, and in the usual proportion, say, for instance, in order to make common yellow soap, seven hundred weight of tallow, three hundred weight of palm oil, three hundred weight of rosin, and about one hundred and forty to one hundred and fifty gallons of caustic soda lees; specific gravity, about 1.10, or containing 11.5 per cent. of real soda, and place the whole in a steam boiler, such as shown in the annexed cut. The boiler should be furnished with a man hole, safety valve, and all the ordinary appendages of such an apparatus, with a thermometer plunged in a mercury chamber. There should be a feed pipe as at *a*, and a discharge pipe as at *c*, through which the soap may be discharged into a pan, or frame, as at *d*. The fire being lighted, the pressure on the valve should be such as to allow the temperature in the boiler to rise gradually to about three hundred and ten degrees of Fahrenheit; when it has remained at this heat for about one hour, the ingredients may be discharged from the boiler into the pan, or frame, and allowed to cool down, when the process of saponification will be found to have taken place.



I will now proceed to describe the manner in which I dissolve the silica, when I am about to make silica soap with silica in that state, and which I do previous to adding it to the other ingredients, whereby I am enabled to determine the quantity of silica to be contained in the soap, or sufficiently so for all practical purposes.

This, which constitutes my second head of improvement, consists simply in putting silica, whether in the state of ordinary black flints, broken to the size of half a cubic inch, or thereabouts, or in combination with other substances with caustic alkaline lees, in the proportion of about 100 weight of silica to one hundred gallons of lees, of the specific gravity of about 1.10, in a steam-tight boiler, with apparatus such as hereinbefore described, and heating the same to a temperature above the ordinary boiling point of such lees, (say about three hundred and ten degrees of Fahrenheit) keeping the ingredients under steam pressure of about fifty or seventy lbs, on the square inch, for about three or four hours, when it is discharged and cooled down; and I obtain a silicate of soda, or potash, according to the alkali used in solution, the strength of which can be ascertained by chemical analysis; and this solution, when silica soap is to be made, may be added in any quantity to the other ingredients when in the pan, or frame, after they have undergone the saponifying process before described, and before they cool down dependent on the per centage of silica required to be in the soap.

Now whereas, I claim as my invention, first, performing the saponifying process of soap making, by heating the ingredients of which the soap is to be composed, in a steam-tight boiler as aforesaid, at the increased temperature

aforesaid, and under pressure as aforesaid; and, secondly, digesting silica in a similar boiler at a high temperature and under pressure aforesaid, and then mixing it with the other ingredients in the pan, or frame, as aforesaid, whereby I am enabled in the first case to cause the perfect combination of the ingredients required for making soap in a much shorter time, with less waste and at a less expense than heretofore; and, in the second case, to cause silica to combine more readily with soap, and to ascertain more accurately the quantity of silica to be contained in silica soap.

ARTHUR DUNN.

Specification of a patent for an improved method of manufacturing Sulphuric Acid. Granted to JAMES HARGREAVES, *Paterson, Passaic county, New Jersey, August* 24, 1839.

To all whom it may concern: Be it known, that I, James Hargreaves, have invented a new and improved method of making sulphuric acid; and I do hereby declare that the following is a full and exact description of the method of making the same:—

I cause the sulphur to be burnt in a pan, in a close furnace, by fire below the same; and the vapour arising from the combustion of the sulphur is forced and driven, by a blast of atmospheric air from the furnace, through a tube leading therefrom to a close receiver filled nearly full of water, and discharged near the bottom of the receiver, in such manner that the vapour ascends through the water to its surface, and by combining with the water, forms sulphuric acid. I also cause the vapour to be met by a blast of steam and atmospheric air while yet in the furnace, and before passing into the receiver, to cause the vapour of the sulphur, or sulphurous acid, to combine with one more equivalent of oxygen, a dry atmosphere being unfavourable to the combination; and the vapour, after passing through the water in the first receiver, rises through another tube fixed in the top of that receiver, and passes through another receiver in the same manner, and so through a third, or more, as may be found expedient; and as the acid in a concentrated state is drawn from the first receiver by a cock at the bottom, the weaker acid from the second receiver is drawn into the first, and that of the third into the second; and thus the water being placed in the last receiver, passes through the several receivers, becoming more and more concentrated, until it is drawn from the first receiver in the form of sulphuric acid.

In order to render the process more effectual, I insert, in the receivers, horizontal shelves, to cause the vapour to pass a greater distance through the water, and these shelves, as well as the receivers, should be covered with lead. The blast of atmospheric air may be made with a cylinder with double blast, or in any other manner to make a steady and uniform blast, and the blast of steam may be made by a boiler over the sulphur furnace.

What I claim as my invention, and desire to secure by letters patent, is the manufacturing sulphuric acid in the manner herein set forth, viz. by introducing a blast of air to force the vapour of the burning sulphur through the water in the receivers, and by introducing a jet of steam with atmospheric air, into the furnace, to meet the vapour of burning sulphur, as herein described.

JAMES HARGREAVES.

Specification of a patent for a method of making Cloth impervious to water, and of adding a Nap thereto. Granted to WILLIAM K. PHIPPS, *of Framingham, Middlesex county, Massachusetts, August* 31, 1839.

Be it known, that I, William K. Phipps, have invented, or discovered, a new and useful method, or process, for making cloth impervious to water, in combination with adding a nap thereto, which I call *talipot cloth*, of which the following is a true, full, and exact description:—

I take a piece of linen, woolen, or other cloth, and laying it on a table, or other smooth and even surface, I apply to it, with a brush, or other suitable instrument, a thin coating of liquid cement, or composition, in an even and uniform manner over its whole surface. The cement I use for this purpose, and the one I consider to be the best, is linseed oil mixed by boiling with some kind of drier, as gum shellac, red lead, and litharge, one pound of each to a gallon of the oil; or the oil may be used as a cement without any drier, in which case the cloth will be longer drying. I usually colour the cement of the same colour the nap is intended to be.

Having thus applied the cement, I take the material of the nap, viz. flock, or the shearings of woolen cloth, the same that is cut off by the cloth dressers in shearing the same, or other description of material, for nap, and scatter it evenly, by sifting or otherwise, over the surface of the cloth, and then let the cement dry. The cloth, when dried, may be dressed in the manner of other cloths, having a nap of similar description.

I call it talipot cloth. It forms an excellent and cheap material for the covering and lining of carriages; for storm coats, and for various other purposes.

What I claim as my invention, and ask a patent for, is the mode of adding nap to cloth in combination with the mode of rendering cloth waterproof, in the manner above described. WILLIAM K. PHIPPS.

Specification of a patent for an improvement in the mode of constructing Railway Tracks, or Rails, to enable cars to turn short curves. Granted to HENRY M. NAGLEE, *Philadelphia, Pennsylvania, August* 26, 1840.

To all whom it may concern: Be it known, that I, Henry M. Naglee, of the city of Philadelphia, in the state of Pennsylvania, Civil Engineer, have invented a new and useful improvement in the mode of constructing, or forming, railway tracks, by means of which improved construction, railway cars and carriages are enabled to run round short curves at the corners of streets, and in other situations, with greater facility than by any other known plan; and I do hereby declare that the following is a full and exact description thereof.

Where curves are to be formed in railways for the purpose of enabling railroad cars and carriages to turn round the corners of streets, or in other situations where it is necessary that such curves should be of much shorter radius than that usually admitted on railway tracks, I construct a rail, usually of cast iron, which rail is to constitute the convex side, or rail of largest radius, in such manner as that the wheel which is to pass around it will run either upon its ordinary tread, or upon its flanch, and will thereby adjust itself to the designated curve. The inner rail of the curve, or that of

shortest radius, may be the ordinary edge rail, or any of the other rails in common use, which may suit the particular location of the curve.

Fig. 1, in the accompanying drawing, is a cross section of the cast iron rail, and of the wheel thereon, drawn to one-half of the actual size. The wheel being shown, as sustained, and running upon its flanch.

Fig. 1.

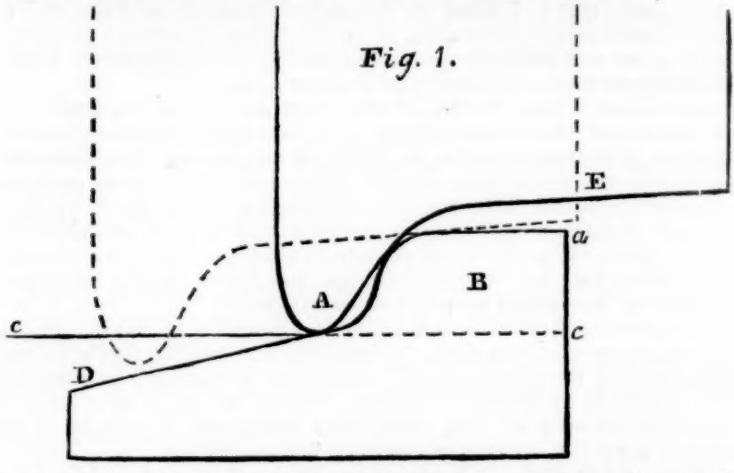
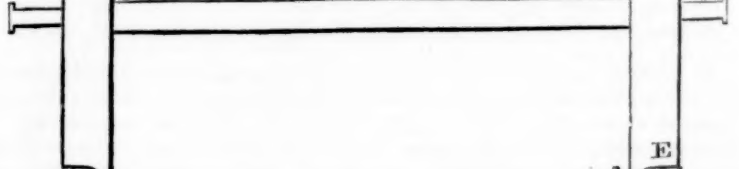


Fig. 2,* is a top view of the two rails, drawn to a reduced size; and fig. 3, a cross section thereof, with the wheels upon the rails.

Fig. 3.



The height of the flanch of the wheel A, fig. 1, is one inch and a quarter, more or less; and upon the outer rail, I make a projection or rise, B, which is elevated above the horizontal line, *c*, *c*, one inch; the inclined plane being continued from this line to the commencement of the elevation, B. When the flanch, A, of the wheel, approaches the projection, B, it will, in consequence of the inclination which I give to the inner portion, D, of the rail,

* Fig. 2, (a horizontal projection of the curve) referred to in the Specification to the Patent, has been omitted, the demonstration of the principle being perfect without it.

be brought into contact with said inclined part, and have its bearing upon it; this will tend to raise the tread, E, of the wheel, above the upper part, B, of the rail, B, *c*, D, upon which it runs, until the curvature of the rail brings the flanch into contact with the inclined plane, which descends towards D, so that ordinarily the tread, E, bears on the elevation, B. It will manifestly be a consequence of this construction, that when the radius given to the curve is less than that which would enable the flanch of the outer wheel, and the tread of the inner wheel, to roll round equably on the respective rails, the flanch of the outer wheel will be brought into contact with, and will roll round upon, a more elevated part of the inclined plane of the outer rail, whilst the projection, B, will serve as an effective check and guide, should the flanch be brought into actual contact with it. When the radius is greater than this, the wheel, in turning, will run alternately upon its flanch and its tread on the outer rail, and will thus become self-regulating; the distance between the two rails being of course so adjusted as to admit of the necessary play.

In fig. 1, the upper and outer angle, *a*, of the outer rail is left perfect, as this will admit of the paving directly up to, and flush with it, when desired; in the other figures, this corner is shown as rounded off, but neither of these modes of forming the rail affects the principle of construction, or manner of operation; *b*, and *c*, figs. 2, and 3, are end views of the respective rails.

Having thus fully described the nature of my improvement in the construction of rails for enabling cars and carriages to turn with facility upon short curves, what I claim therein as constituting my invention, and desire to secure by letters patent, is the manner of forming the outer rails of such curves with the projection, B, and the inclined plane, D, in such manner, and in such proportion to the flanch and tread of the wheel, and the curvature of the rails, as that they shall co-operate in the manner set forth, in producing the effect herein fully described, the inner rail, in this case, being one of the ordinary kind, and a grooved, or guard, rail not being necessary, or indeed admissible. HENRY M. NAGLEE.

Remarks by the Patentee.—Curves of radii varying from fifty to one hundred and twenty feet, constructed upon the above plan, have been in very successful operation during the last five months at the New York depot in Philadelphia, giving entire satisfaction to the railroad company, and meeting the most sanguine anticipations of the patentee and his friends.

The dotted line represents the wheel, sustained upon its tread, which will be its position when the wheel which is upon the edge rail is running with its flanch in contact with it. Also shown in fig. 3, which is a cross section, with the wheels upon the rails.

Important Improvement in the Manufacture of Counterpanes, or Bed-quilts.

Mr. Erastus B. Bigelow, of Lancaster, Massachusetts, who is the inventor of a power loom for weaving figured goods of various kinds, and of one for weaving coach lace, which is in successful operation, has recently obtained a patent for a power loom for weaving figured counterpanes, which he denominates the *Paisley counterpane.* The goods produced in this loom are of a quality very superior to such as are produced in the hand loom; at all events we have not met with any thing of the kind in the shops that will

compare with them for texture, and for beauty and regularity of pattern We speak advisedly on this point, having two of them in use, that have been examined by persons who are good judges in such matters. Of their durability there cannot be any doubt, and the friends of domestic industry will be glad to learn that the manufacture is so much facilitated by the invention of Mr. Bigelow, as to cause them to be afforded at a price considerably below that at which those of an inferior quality can be imported, and yet to give a satisfactory remuneration to the manufacturer.

They are made of the largest as well as of the smaller sizes; and that we have is about fourteen quarters square.

We shall not here attempt to describe the loom, as this would require a drawing, and would be interesting to manufacturers and machinists only; we speak of these counterpanes now, for the purpose of calling attention to an article which every housekeeper wants, and the cost of which has hitherto stood in the way of their being as generally used as they are now likely to be. We anticipate that at a very early day, American counterpanes will become as general as berths on board steamboats, and as beds at hotels. The articles are for sale in all our large cities, and as soon as there is a sufficient supply, will make their way into every part of the Union.

On the Manufacture of White Lead from the Pulpy Oxide produced by Attrition.

At p. 124 of our last number, after giving the specifications of three patents, in each of which the first step in the manufacturing of white lead was the producing of a pulpy oxide by the friction of fragments of lead in water, we made some remarks tending to show that this process was not of recent origin, and ascribed the invention of it to Joseph Richards, of Philadelphia, who obtained a patent for it on the 28th of May, 1818. We have since turned to some memoranda on this subject, and find that a patent of still earlier date, was obtained by George F. Hagner, of Philadelphia, which patent was granted on the 13th of October, 1817. The manufactory established at Norristown was under Mr. Hagner's patent. The following is an extract of a letter written in answer to an inquiry made by us about two years ago, and which was not at hand when the remarks above alluded to were written. The writer of the letter was not concerned in the manufactory at Norristown, but is perfectly familiar with the different processes which have been followed in obtaining, or attempting to obtain, carbonate of lead.

"The mode used by Mr. Hagner, who is the patentee, was to granulate the lead, casting it, in a melted state, into water; the granulated lead was then placed in a cylinder with a small portion of water, and the cylinder being made to revolve, caused a disintegration of the lead, and a partial decomposition of the water, producing a white lead, which was washed and ground in the usual manner. At first, owing to its fine colour, it obtained purchasers; but it was found that when used it turned yellow in a few days; and I was informed by one person that this change took place in forty-eight hours, when exposed in a warm situation. My supposition was, that this was occasioned by the loss of a portion of carbonic acid, but partially combined with the lead, and the consequent production of a yellow oxide. The sales in this city were very limited; the manufactory continued in operation about two years, and as it was very extensive it must have sunk a large

sum of money." The foregoing account says nothing of the manner in which carbonic acid was supplied to the lead, and would lead to the inference, therefore, that it was obtained from the atmosphere only. It will be proper to remark, however, that the inquiry related principally to the triturating process, and that the letter was not intended to make known the particulars of the manipulation, nor is it supposed that the writer had informed himself on this and other points; besides which many years had elapsed since he had thought upon the subject. We have recently written to a gentleman who is said to have been the conductor of these works, and hope to obtain all the facts of importance relating to them. The destruction of the records of the Patent Office prevents our obtaining a copy of the specification of Mr. Hagner's patent, but if we had this, it would probably throw no more light on the subject than is afforded by that of Mr. Richards, which we have obtained, and is as follows:—

"The discovery consists in the forcible introduction of atmospheric air, by means of a bellows or otherwise, into or through the cylinder, or barrel, in which lead is put for attrition by water, whilst the cylinder or barrel is revolving; or in other words, the application of a current of atmospheric air to lead whilst it is undergoing the process of attrition by water, for the purpose of producing a perfect carbonate of lead within the cylinders.

JOSEPH RICHARDS."

The foregoing process, it will be seen, contemplated the supply of carbonic acid by the introduction of atmospheric air only; whether it was subsequently derived from any other source in Mr. Hagner's establishment, we shall probably learn at an early day, and if so, we shall publish the fact. There must be among our readers some persons well informed in this matter, and we earnestly request that they will take the trouble to communicate what they know of the case to us, or to the Actuary of the Institute.

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a patent granted to CHARLES HULLMANDEL, *of the city of Westminster, lithographic printer, for his invention of a new mode of preparing certain surfaces for being corroded with acids, in order to produce patterns and designs for the purpose of certain kinds of printing and transparencies.*—[Sealed 26th March, 1838.]

My invention consists, first, in drawing narrow or broad lines, so as to produce figures or patterns directly on the surfaces of copper or steel, or other metallic or glass plates, or rollers, and without the previous intervention of any resinous or other ground or covering, with a composition or mixture soluble in water, and which mixture, when the plate has been subsequently covered with varnish and steeped in water, will dissolve and rub off with the varnish which is over it, thus exposing the surfaces which were under the mixture to the action of any acid which may be used to corrode the same; and secondly, in the application of grease to such surfaces as aforesaid, for the purpose of obtaining a reticulated or irregularly exposed portion of the same for the action of such acids as aforesaid, for the purpose of producing shaded figures or patterns, as hereinafter explained.

A sheet of parchment marked A, with a number of specimens, figures, and patterns, accompanies the specification by way of illustration. It must, however, be evident, that from the nature of the specimens it would be impossible to give any correct graphic representation of them here; but, in order that our readers may have all the information we are enabled to furnish, we publish the specification verbatim, with all the references to the sheet of specimens registered in the Court of Chancery.

Description of the new method.—First, I mix seven parts of a thick solution of gum arabic (say about the thickness of cream) with about one part of treacle and a small quantity of the best lamp black to give it a colour, and grind them well together; or to speak more accurately, take of treacle nine grains; gum arabic in powder eighteen grains; best lamp black nine grains; mix with water to the consistency of cream, and grind well. The object of the treacle is to hinder the gum from chipping off, which it would otherwise be apt to do from the surface of the metal or glass. With this colour and a camel's hair pencil, I draw on the naked surface of the metal or glass, whatever subject, figure, or pattern, is intended, a sketch or tracing of the same having been previously transferred to the surface of the metal or glass by the usual means of tracing paper or otherwise; if, however, straight lines only are required to be produced, the common mathematical pen and a rule, or a common quill or steel pen may be used, according to the nature of the subject. The specimens Nos. 1, 2, 3, and 4, in sheet A, represent the sort of patterns or figures that may be so drawn as aforesaid. No. 1, being drawn with a camel's hair pencil or brush, and Nos. 2, and 3, with both a common quill and mathematical steel pen; No. 4, being drawn with both a camel's hair brush and mathematical pen.

The pattern or design being thus completed in outline, a varnish must either be poured on the plate or else spread on with a flat brush, so as to lay perfectly even on the surface. If the pattern or design has been executed on a cylinder or roller, an axis or spindle must be fitted to the roller, and the whole fixed on to a stand, so as to turn by means of a handle or otherwise, and the varnish being laid on with a flat brush over the whole surface of the roller or cylinder, it should be turned round on its axis with a slow and even motion, until the varnish has spread evenly over its whole surface and is set. I lay no claim to any peculiar varnish; but I prefer for this part of the process, a mixture of four or five parts of what is called in Paris, "petit vernis," and one part of what is commonly sold in London, under the name of Brunswick black; the surfaces of the metal or glass with the designs upon them being thus coated, the varnish must be allowed to dry for twenty-four hours, when the plate or cylinder, as the case may be, must be steeped in water for two or three hours, and afterwards by gently rubbing the surface with a soft hair pencil or a sponge, the varnish will leave the metal wherever the mixture above-mentioned of gum and lamp black has been previously applied, as well as the said mixture itself; and that part of the surface, which is intended to produce the pattern or design, will be left completely uncovered, and prepared for being bitten or corroded to the depth required, by such acid as is usually employed for biting or corroding, according as metal or glass has been used, in which latter case, fluoric will of course be the proper acid. The parts thus exposed as aforesaid, having been sufficiently corroded or bitten, the varnish must be removed with spirits of turpentine in the usual manner, and the surface well cleaned.

The second part of my said invention is, the preparing the said surface for biting in the shadows for the pattern or design, obtained in outline, as be-

fore described. For this purpose I take a very small quantity of tallow, or grease of any kind, on a rag or piece of wash leather on the tip of the finger, and rub the surface of the plate or roller with it, so as to grease it all over slightly, though perceptibly; this done, the said surface must be rubbed with a dry soft cloth or rag, and this operation of rubbing with a rag must be repeated two or three times, until the surface of the metal appears to be well wiped, and no visible grease left, though, in fact, there must be a greasy coating over the whole surface.

A mixture of a solution of equal parts of gum arabic and gum tragacanth must then be prepared, to which solution, treacle must be added in the proportion of one part of treacle to five parts of the solution, and the whole well ground with a small quantity of good lamp black or any other coloring material, merely to give it a colour; or to speak more correctly, take of powdered gum arabic, twelve grains; powdered gum tragacanth, seven grains; put these in solution in a little water for two days, and then add treacle, nine grains; best lamp black, ten grains; and grind all well together. On applying some of this coloured solution with a camel's hair pencil to the surface prepared with grease as aforesaid, the solution will retract or withdraw itself into reticulated or irregular forms, or a sort of net work, as exhibited in specimen No. 5, which shews the effect produced by merely dabbing or drawing a brush containing the mixture over the prepared greasy surface of the plate, by which means, if laid on in an artist-like manner, forms and shading can be produced with the greatest ease and rapidity, as shewn by the specimen or shaded pattern specimen No. 6, which is the same specimen figure of No. 1, with the shading added thereto. Specimens 7, 8, and 9, also shew the effect produced by the novel kind of shading in different figures or designs. Specimen No. 10, shews the same effect of shading, the design or pattern being on a dark ground, produced by dipping a small piece of soft sponge in the ink or mixture, and dabbing it upon the prepared greasy surface; or the same effect may be produced by a dabber, commonly used by engravers in laying on etching ground, the dabber being covered with soft wash leather, and dipped in the ink, and applied to the surface of the metal, plate, or cylinder. The closeness or openness of this network or shading can be modified by using the colour thicker or thinner.

By this second method of preparing the surface, it is evident that original figures, patterns, or designs, may be executed, or else it may be used to produce shadings to the patterns previously designed or corroded by the first-mentioned process. In the case of designs and patterns for printing on silk, cotton or woolen fabrics, these may be either wholly produced by one or other, or both of the methods before given, or part of the patterns or designs may be executed by the methods already in use, and the shading produced by the second part of my said invention herein before described. The design or pattern being completed by shading as aforesaid, the varnish is laid on as already explained, for the first part of my said invention, and the parts which are intended to be corroded or bitten, uncovered by again steeping the plates or rollers in water, and gently rubbing as before mentioned.

When the pattern is small and often repeated, as shewn in specimens Nos. 11, 12, and 13, it can be executed in wood in the ordinary manner of block printing, or in metal; and by charging the pattern thus carved or engraved with the aforesaid gum and lamp black, and fine sand, which are to be mixed in about the following proportions:—gum arabic in powder, forty grains;

best lamp black, six grains; very fine sifted sand, fifty grains; or else gum arabic, forty grains; lamp black, six grains; powdered pumice stone, sixty grains: this ink must be very slightly ground. In the first recipe the lamp black and gum in solution must be ground together, and the sand added afterwards. The plates or blocks being charged with the mixture in the same way that a wood block or engraving is charged for printing on calico or paper, the small design may be repeated on the naked surface of the metal or glass as often as is required, the whole being then covered with varnish, afterwards soaked in water, and corroded with acid as before described.

Now, whereas, it is evident, that patterns and designs may be produced by the use of either the first or second part of my said invention, as well as by both combined, and that clean, even black lines, may be produced on the greased surface by the addition of a little gall to the gum solution, as well as on the bare surface of the metal or glass, the Nos. 11, 12, and 13, being specimens of the several styles.

And whereas, I do not claim as my invention the use of any peculiar varnish, or of any peculiar solution or colouring matter for the purpose aforesaid; but I do claim, first, the application of these materials, mixed in manner aforesaid, directly on the bare surface of metal or glass plates or rollers, as herein before explained, with reference to the first part of my invention; and then varnishing and steeping the said plates or rollers in water, and rubbing off part of the said materials as aforesaid, and thus preparing the said surfaces, to be corroded or bitten with acid, so as to produce patterns and designs as aforesaid, for the purposes aforesaid.

And secondly, I claim the preparing of surfaces of metal or glass by greasing them as herein before described, so as to produce a sort of net work, or irregular marks, shading patterns, or designs, for the purpose aforesaid, when drawn upon in manner aforesaid, and afterwards varnished, steeped and rubbed, as explained in the second part of my said invention.

Lond. Jour. Arts & Sc.

Specification of a patent granted to WILLIAM NEALL CLAY, *of West Bromwick, in the county of Stafford, manufacturing Chemist, for his invention of improvements in the manufacture of iron.*—[Sealed 19th December, 1837.]

There may be said to be three classes of iron ore:—First, the common argillaceous iron stone, generally used in the manufacture of iron in Great Britain; secondly, the rich carbonates of iron, containing little earthy matters, which, when roasted, part with their carbonic acid, and absorbing oxygen, become, (after roasting,) oxides of iron; thirdly, native oxides of iron, either pure or combined with silica, and in very small quantities, other earthy matters; and according to the ordinary means now pursued, from making iron from iron ores, it is well known that that description called argillaceous ores, are commonly employed; such for instance, as are found in the coal fields of Staffordshire, Wales, Scotland, and in other places; and in making iron from such ores, they are in the first instance submitted to the process of roasting, and the iron stone or ore thus treated, is called "burnt mine," "roasted mine," or "roasted ore;" such *burnt mine*, *roasted mine*, or *roasted ore*, with suitable fuel and fluxes, is then submitted to the process of smelting, in large blast furnaces, and run therefrom into what are

called pigs, or in some cases directly used for iron casting. In case such pigs are to be converted into malleable iron, they are submitted to the processes of the refinery and puddling furnaces, all which is well known and in extensive practice in this country; and in some instances, iron masters have recourse to the mixture of certain portions of the red and other rich iron ores of Cumberland, Lancashire, North Staffordshire, and other places, with the roasted argillaceous iron ores above mentioned, in order to enrich those poorer ores. But such is the peculiar property of the rich iron ores referred to, under the heads secondly and thirdly, that they are not capable of being manufactured into iron by the process above stated, when used alone, although I believe that some of the rich Lancashire ores are for particular purposes, and mixed with a small portion of poor ore, at considerable cost, reduced by means of charcoal in blast furnaces.

Now it is well known that the red and other rich ores, above mentioned, contain much more iron in a given quantity of ore, than the argillaceous ores, mainly employed; and the veins of such ore are in many places in great thickness; but up to this present time, the ores under the heads secondly and thirdly, have not by themselves been brought into practical working, but have only been partially used, combined with poorer ores, in the manufacture of iron.

Now the first object of my invention relates to a mode of working such rich ores, and producing malleable iron therefrom by a very simple process and at a very small cost compared with processes now employed for making iron from argillaceous iron stone or iron ore.

I will now proceed to describe the process I have pursued and found to answer, and which in combination with the converting of the richer ores, on a practical scale, constitute my invention.

I take any quantity of the red Lancashire or Cumberland ore, or other ores of a rich character, and break the larger lumps by means of a pair of rollers or otherwise, to about the size of walnuts, which I believe to be the best size for working;—with one hundred parts, by weight, of such broken ore, I mix twenty parts of clean dry coal ashes or cinders, or of coke, charcoal, charred peat, anthracite coal, or other suitable carbonaceous matter, broken so as to pass through a sieve of half an inch mesh. This mixture is to be put into retorts or vessels, which I prefer to be of a ⌓ shape, about seven feet long and eighteen inches high, and two feet wide, made of clay, fire brick, iron, or other suitable material, capable of sustaining bright red heat by daylight. These retorts I prefer to be fixed horizontally, in a chamber which may be constructed at the end of a puddling or other furnace, so that the otherwise waste heat of the furnace may be employed for heating such retorts and their contents, to a bright red heat, at which degree of heat the contents should be kept some time.

The chamber for the retorts is built suitable for containing several retorts (according as the puddling furnace is capable of supporting the requisite degree of heat,) between the end of the puddling furnace and the chimney, leaving a sufficient space, so as not to impair the draught of the puddling furnace; and I prefer that the ends of the retorts should be so much above the ground, that there may be an iron barrow run alongside, to receive the charges of the retorts as they are discharged.

By this arrangement the flames and heated vapours passing from the puddling furnace, heat the retorts or vessels on the exterior, without having access to the iron ore in the retorts. One end of each of the retorts is stopped with a door in a similar manner to that adopted in retorts for dis-

tilling coal for gas, so that they may be readily opened to discharge, and may be immediately charged and again closed, for it is desirable to be constantly working, so long as there is sufficient heat, and the retorts and furnace are in proper repair,—the capability for which constant succession of charging and discharging, is an important feature of utility in my process, for it does not require that the retorts should ever be cooled down, but, as above explained, so soon as one charge has undergone the process and is discharged, a fresh charge is to be put into the retort, and there are to be pipes connected with the retorts, to carry off the vapours evolved in the process, similarly to gas retorts, in making coal gas, which may be conveyed to the chimney or elsewhere.

In charging these retorts, I fill them with the mixture of iron ore, and cinder, coke or coal, above described, until it reaches to the boundary line of the flues which heat the retorts; I then add two or three shovels full of cinder, coke, &c., and close the door, so as to prevent the ingress of any atmospheric air. In this condition, the retorts are to remain for twelve hours or upwards, the duration depending on the degree of heat applied; but the completeness of the process may, at any time, be ascertained by taking out some of the pieces of ore from the retorts, by means of tongs, and with a file filing the surface of such ore to ascertain whether it has arrived at the metallic state; a very little practice will suffice to enable the workman to judge accurately of the process.

The charge on being drawn from the retorts may (when the product is to be made into malleable iron,) be immediately conveyed into a puddling or balling furnace, and if the product appears not to be generally in a metallic state, five per cent. or more, of small anthracite coal or other carbon, is to be put into the puddling furnace with it. The prepared iron or product from the retorts is to be balled in a furnace of the customary description, as if treating "refined iron" of the ordinary process of manufacture, and it will "come to nature" very readily, and may be said to be a welding of the many parts into balls rather than puddling; and after the cinder is well worked out it may be balled or looped, (or by whatever other name the process is called,) and taken to the hammer, or rolled according to the will of the operator.

I have here described the retorts as being set in a chamber applied to a puddling furnace, in order to use the otherwise waste heat at the same time. I do not confine myself thereto, as a chamber with retorts may be heated by other furnaces, and although I have mentioned twenty parts of cinder, coke, charcoal, anthracite coal, or other suitable carbonaceous matter to one hundred parts of ore, I do not confine myself thereto,—the object is to have sufficient. I have found, that a larger quantity than is really necessary for the process, at the degree of heat above mentioned, is not prejudicial, but it has fully effected the object of my invention.

And I would further remark, that although I have mentioned particular sized and shaped retorts, and their being set in a horizontal position, I do not confine myself thereto, as the same may be varied, provided the character of my invention, as above explained, is otherwise retained; and although I prefer the using of retorts, such as are herein described, having the requisite heat applied to the external surface thereof, I do not confine myself thereto, as large masses of iron ore may be heated, according to my invention, and a furnace similar to a conical lime kiln, may be employed, in pursuing this mode of carrying out my invention.

I place a mixture of one hundred parts of ore with sixty parts of coal,

coke, or other suitable carbonaceous matters, or thereabouts, in the kiln, and having fired and raised the kiln to a very bright red heat, as equally as possible, I then prevent all further ingress of atmospheric air at the lower part of the kiln, by stopping up the apertures;—having thus stopped all admission of air from below, I put five or six inches of anthracite coal, coke, or other suitable carbonaceous matter, on the surface; by this mode of treatment, the fuel in the ignited kiln, being deprived of all further supply of atmospheric air, will so act upon the iron ore as to reduce it into the metallic state,—and the progress of such working may be ascertained by taking out portions, from time to time, as explained in respect to the retorts; and when it is judged that the iron ore has become deoxydized, the charge may be drawn, and a fresh one immediately supplied to the kiln or furnace.

I would, in conclusion, further state, that when it is desired to make cast iron, according to my invention, I charge the retorts with thirty parts, by weight, of the carbonaceous matter or matters, above named, to one hundred parts of the rich iron ore, and continue the application of heat for a longer time, say for half as long again, than for simply reducing the iron to a metallic state,—for in order to make cast iron, it is necessary to impregnate it with carbon to that extent, that it will readily melt when taken to the cupola furnace of an iron founder, who may then use it as he would the broken pig iron of the old process.

I would remark, that I am aware it was several years back proposed to melt such rich iron ores in pots or crucibles, with charcoal or other carbon, in order to produce steel by such process;—I do not therefore claim any process of retorts or vessels, or kilns for treating such rich ores with carbon, where smelting is performed; and I am aware that as a chemical fact, it is known that iron may be obtained by cementation, from burnt argillaceous ore,—and further, it has been proposed to submit "burnt mine," "roast mine," or "roast ore," in a practical form, according to a system of tests, to the well known process of cementation, like that pursued in converting iron into steel in closely cemented vessels, such process of tests requiring the heat to be gradually raised to the proper high degree of temperature, then retaining the same to that heat for many hours; and then gradually cooling down the same before drawing the charge, by which it was proposed to produce steel and iron from roasted mine, such process being the subject of a patent, in the name of John Isaac Hawkins, dated the fourth day of July, one thousand eight hundred and thirty-six; but such process of test and cementation, would probably be at much greater cost than reducing the like roast mine, or ore, by the ordinary blast furnace, which, as is well known, is the usual mode of making iron from like materials; and I have mentioned the processes, to state, that I lay no claim thereto; for my invention relates only to the working of the richer ores, and such as are not reducible by the ordinary means of blast furnace; and does not relate to the roasted argillaceous ores, commonly employed in the manufacture of iron; and moreover, it is not necessary previously to roast such rich ores, as I have above mentioned; and it would be only an unnecessary expense so to treat such ores. Ibid.

Specification of a Patent granted to CHARLES ADOLPHE ROEDERER, *of Strasburg, but at present residing in the City of London, for an Improved Method or process of Manufacturing or Preparing the Chemical Salts called Acetates.*—Sealed April 9, 1839.

The various processes which have hitherto been employed for the formation of acetates, and in particular the acetate or sugar of lead, consisted in mixing the base with liquid acetic acid, either in a concentrated or weak state. But this mode of operating is productive of many serious disadvantages, amongst which may be mentioned, the expense of fuel, of apparatus, of labour, and of time, the loss of acid, and the difficulty of producing acetates capable of perfect crystalization and of pure quality. Most of these disadvantages are obviated, and the remainder considerably moderated by my improved process, which consists in employing the acid in the state of vapour, to act upon the bases, instead of using it in the liquid form. I provide a vessel of adequate capacity for the quantity of acetate I wish to make at once, and constructed of such materials as will not readily be destroyed by the acid. The top of this vessel I close hermetically by a cover, fastened down by any convenient means; and in the lower part of the vessel I place either a minutely perforated false bottom, or a coiled tube of several convolutions, minutely perforated, to permit vapour to pass through freely. To prevent the loss of acid I also place, at different degrees of elevation, several perforated diaphragms, similar to the false bottom just mentioned, on each of which I spread a layer of litharge (if I am making acetate or sugar of lead, or a layer of other proper base, according to the acetate required;) after which the cover of the vessel is to be accurately closed. By means of an ordinary distillatory apparatus, I convert liquid acetic acid (strong or weak, pure or impure) into vapour, which vapour I conduct by means of a pipe, into the convoluted perforated pipe before mentioned, or between the real bottom of the vessel and the perforated false bottom; hence the vapour passing through the numerous perforations of the false bottom and diaphragms, diffuses itself throughout every part of the vessel, its acid entering into combination with the base employed, and forming the acetate which falls to the bottom of the vessel, and in its descent meets with the ascending streams of vapour, the acid of which renders it perfectly neuter; meanwhile the more aqueous parts of the vapour becoming liberated, and maintaining their temperature, ascend, and in their passage through the successive layers of the base are thereby deprived of their remaining acid. The vapour thus reduced to simple steam, is allowed to escape through one or more pipes at the top of the vessel, and as this steam still maintains a boiling temperature, I conduct it through a worm to evaporate the acetates or the mother liquor by its heat. The distillation of the acid is continued, until the acetate in the vessel is arrived at the proper degree of concentration for crystalization, which is easily ascertained, by examining a small quantity drawn off by a cock at the bottom of the vessel, by which cock the whole contents are discharged when the operation is completed.

As the operation draws to its close, by nearly all the base having combined with the acid, the vapour issues out of the vessel charged with a certain portion of acid, and in order that no loss may be sustained by its escape into the atmosphere, it is conducted into another vessel prepared like the first mentioned, but charged superabundantly with the base, to take up ev-

ery particle of the acid issuing out of the first vessel, until the operation in the first vessel is ended.

The great saving of fuel effected by my process is evident from these circumstances, that my operation finishes where the ordinary one begins, and that the mother liquor is evaporated by the latent heat of the aqueous vapour, before it is discharged. The apparatus is extremely simple and cheap, being also self-acting, much labour is avoided by it; and finally as the temperature of the solution or the acetate can never exceed that of the vapour, the crystaline product is of finer quality than ordinary.

Rep. Pat. Inv.

Specification of the Patent granted to WILLIAM WIESMANN, *of the City of London, for Improvements in the Manufacture of Alum.*—Sealed November 16, 1839.

My invention relates to a mode of manufacturing alum, by which the same may be produced free of iron and alkali, (or nearly so.) And in order to give the best information in my power, I will proceed to describe the process pursued by me. I take potters' clay, as free from iron as possible, and calcine the same to a moderate red heat, in order, as much as possible, to drive off all humidity. The clay so calcined is next to be ground to a powder, and to be placed in leaden pans heated by a moderate fire, or by steam, and sulphuric acid (about 66° by Beaumé) is to be applied in sufficient quantities, that the acid may dissolve nearly the whole of the clay. I prefer that the whole should not be dissolved, as a saving of acid is thereby obtained. The mass in the pan is to be stirred until it is dry, when boiling water is to be applied to dissolve the salt formed, and water is to be so applied till the whole of the salt is separated; the liquids thus obtained, are mixed and placed in vats, and left therein till perfectly clear. A measured quantity of the liquor is to be tested with prussiate of potash, or other suitable material, to ascertain the quantity of iron contained in such measured quantity of the liquor, then the whole quantity of liquor being known, the quantity of iron therein may be obtained by calculation, and whatever be the weight of iron the liquor to be operated on is found to contain, an equal weight of prussiate of potash, dissolved in water, is to be stirred into the liquor, which will take to the iron, and they together will be precipitated; by this means, the liquor drawn off clear or filtered, will be composed of sulphuric acid, alumina, and water, and in this condition, may be used for the purpose of the arts; but when required to be crystalized, I reduce the liquor by quickly boiling and strong evaporation, and evaporate it in large leaden vessels until a skin of salt forms on the surface, when the liquor is drawn into shapes, where it cools and crystalizes. I would here remark, that I am aware that clay treated with sulphuric acid, has been employed in the process of making alum, but the processes have been conducted in a different manner, requiring much time, and producing alum not so pure and concentrated. I do not, therefore, claim the same generally, when practiced according to the means heretofore known. And, although I prefer the employment of prussiate of potash for precipitating the iron, I do not confine myself thereto, as other materials may be used, such as the lixivium of blood, or sulphate of lime. But what I claim is the mode of making alum from clay, as herein described, whereby the alum will contain as much more alumine, and is free or nearly free from iron.

Ibid.

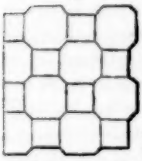
Specification of a Patent granted to ROBERT CAREY, *of the county of Kent, gentleman, for certain Improvements in paving or covering streets, roads, or other ways.*—[Sealed 29th January, 1839.]

This invention is for using wooden or stone blocks of a particular shape, so that they may be enabled to support one another. The shape used by the patentee, is represented at fig. 1, which is a side view or elevation of three or four blocks, put together in the same way as they would be on a roadway. Fig. 2, is a plan view of fig. 1.

It will be seen that each separate block both supports and is supported by all those with which it is in contact, so that upon a weight being placed upon any particular block, the four surrounding blocks each assist in supporting the same, as, indeed, do all the other blocks for a considerable distance round, because it is impossible for any block to sink without carrying down four others with it; and these others are, in their turns, supported by such other blocks as they may be in contact with. It will, therefore, be evident, that the strength necessary to support any weight, will be obtained from all the surrounding blocks.

Fig. 1.

2



The claim of invention is constructing blocks of wood, which, when placed together and accurately fitted, shall alternately present a concave and convex form, as seen in the drawing, and thereby tending to support each other.

This appears to us to be the best description of wood paving yet offered to the public, and would be the most likely to meet with encouragement, if any economical method could be devised for cutting or forming the blocks with correctness.

Lond. Jour. Arts & Sci.

Specification of a Patent granted to JAMES STEVENSON, *of Leith, and* JOHN RUTHVEN, *of Edinburgh, for their invention of a method of cutting wood by certain improved instruments.*—[Sealed 28th April, 1835.]

Instead of employing circular or longitudinal saws, of the ordinary construction, for the purpose of cutting wood, the patentees have invented an improved instrument, which consists of a circular disk of steel or iron, having sockets formed round its periphery for the purpose of receiving the cutting tools, which are thin pieces of steel similar to chisels, and ground to a fine edge. Upon rotary motion being communicated to this circular disk of iron, the chisels, which are fixed in the sockets, cut the wood away without wasting any in saw-dust, as is the case with common circular saws. These small tools or chisels may be adapted to a longitudinal piece of thin iron, so as to form a long saw, if required.

The claim of invention is for using tools of the above description for cutting wood, in the place of the teeth of a common saw.

Lond. Jour. Arts & Sci.

Specification of a Patent granted to JOSEPH SKINNER, *of the city of London, civil engineer, for his invention of certain improvements in machinery for cutting wood, for veneers and other purposes.*—[Sealed 29th December, 1835.]

The wood is cut by a stationary, longitudinal knife, against which the block of timber is pressed by what the patentee calls a compressing edge or roller, and the thickness of the veneer is regulated by two upright

screws, which cause the block to descend to the amount of the required thickness of the veneer, after the knife has cut off one thickness.

Ibid.

Specification of a patent granted to HARRISON GRAY DYAR, *and* JOHN HEMMING, *both in the county of Middlesex, for their invention of improvements in the manufacture of carbonate of soda.*—[Sealed 30th June, 1838.]

The nature of our invention consists in the use of carbonate of ammonia (that is, the sesqui-carbonate or bicarbonate,) in the manufacture of carbonate of soda, by applying it to decompose common salt, and also in afterwards restoring or recovering the ammonia which has been so used, or the greater part thereof, in such a way as to allow of its being used again to convert other portions of common salt into carbonate of soda, thus repeatedly producing successive portions of carbonate of soda from the same portion of ammonia. To render the description of our process more intelligible, we divide it into two parts. The first part being the description of our method of using the sesqui-carbonate or bicarbonate of ammonia in the manufacture of carbonate of soda. The second part being the description of our method of restoring or recovering the ammonia, or the greater part thereof, in such a way as to be again employed in converting other portions of common salt into carbonate of soda.

As to the first part:—The carbonate of ammonia of commerce is what the chemists call the sesqui-carbonate, and in describing our process, we shall use the term carbonate of ammonia, as denoting the sesqui-carbonate. The bicarbonate is not generally met with, but is to be preferred when it can be obtained; and, accordingly, in reproducing the ammonia, we recommend the process to be carried on in such a manner as to produce as much of the bicarbonate as possible. We take nearly equal quantities by weight of common salt, otherwise called chloride of sodium or muriate of soda, and of carbonate of ammonia. We dissolve the common salt in as much water as is barely sufficient to dissolve it, so as to constitute a fully saturated solution, and when so dissolved, we add to it the carbonate of ammonia in the solid form, but bruised or pounded to a state of fine powder. We prefer that the common salt should be the substance dissolved, and to add to it the said carbonate of ammonia in a pulverized state; but the result may be obtained by dissolving the ammonia, and adding the common salt in a state of powder: but according to our experience this is not quite so well. We mix these well together, and suffer them to remain thus mixed from ten to twenty hours, stirring or agitating them from time to time, to prevent the solid parts from settling before the chemical action is sufficiently complete. We then drain or filter the liquid from the solid matter, and in order to separate as perfectly as is convenient all the liquid from the solid matter, we press the substance in an ordinary hydraulic or screw press, or submit it to considerable pressure by any other convenient mode. The solid matter thus obtained is chiefly a carbonate of soda, containing, however, more carbonic acid than is found in soda ash, or crystals of carbonate of soda, of commerce. To remove this excess of carbonic acid, and to recover any ammonia contained in the carbonate of soda, we next place the solid matter so obtained, as aforesaid, in a retort or other convenient vessel, and heat it from about six hundred degrees to eight hundred degrees Fahrenheit, until all the liquid and volatile matter contained in it is drawn off by that heat. The substance left in the retort is the carbonate of soda.

We pass the matter thus volatilized into a cool chamber or refrigerating apparatus; an example of which is furnished by the lead balloons used in the condensation of carbonate of ammonia, in the usual manner, wherein the carbonate of ammonia becomes condensed; but any convenient mode of condensing ammonia may be adopted.

As to the second part:—the liquid separated from the solid matter, that is to say, from the solid carbonate of soda by the pressure in the operations described in the first part of this specification, or by filtration, contains in solution muriate and carbonate of ammonia, common salt, and probably also a small portion of the carbonate of soda formed. In order, therefore, to separate the carbonate of ammonia therefrom, we place it in a distilling vessel, and distil over the water and the carbonate of ammonia, and receive the product in a cask or proper vessel which we keep filled with carbonic acid, obtained from any economic source, in order to prevent loss of ammonia; or instead of distilling over, as above described, the water and the carbonate of ammonia, we add to the liquid a solution of muriate of lime, or chloride of calcium, which is one of the results of our process, until a precipitate, which is chiefly carbonate of lime, ceases to fall. We separate this precipitated carbonate of lime by filtration or other means from the liquid, which is then chiefly a solution of muriate of ammonia and common salt. We evaporate this by heat to a sufficient consistency, to enable us to separate the common salt (in cases where it is desirable to do so on account of the value of common salt,) which being less soluble in hot or boiling water than muriate of ammonia, crystalizes first, and may be separated by well-known means. When the common salt is removed from the liquor (if desirable, or without that process if not thought worth while,) we evaporate by gentle heat the muriate of ammonia to dryness, and mix it intimately with a sufficient quantity of pounded chalk, and heat the mixture in an iron retort or other proper vessel, until the carbonate of ammonia, formed by this operation, is sublimed and separated in the usual way. We receive this carbonate of ammonia in a chamber or vessel formed of lead or other suitable material, where it becomes condensed; and we make a communication by means of a pipe between this chamber or vessel, and another chamber or chambers. Into one or more of these chambers we cause the carbonic acid and other volatile matters to pass, which were expelled by heat from the carbonate of soda, formed, as before described, in the first part of this specification. We receive the carbonic acid into one or more of these chambers, for the purpose of preventing loss of ammonia, by converting free ammonia into carbonate of ammonia, or bicarbonate of ammonia; and if the carbonic acid from the soda is not sufficient for this end, we pass more into them, which we obtain from coal, coke, charcoal, or any other economic source, as well as a sufficient quantity of water, or vapour of water, to condense and save the ammonia. Or in order effectually to prevent the loss of ammonia, we pass into the last of the vessels or chambers we employ to receive or condense the carbonate of ammonia, a sufficient quantity of muriatic acid gas, obtained by adding sulphuric acid to common salt, or from any other economic source. The muriatic acid gas combining readily with the free ammonia, or the carbonate of ammonia in vapour, forms muriate of ammonia, and thus precipitates in the chamber; by which operation we avoid any loss of ammonia that might otherwise ensue. The muriate of ammonia thus obtained we treat in the same manner as the muriate of ammonia separated from the liquids before described, so that this muriate of ammonia may be converted into carbonate of ammonia or bicarbonate. The carbonate of ammonia obtained or reproduced or

recovered from distilling the muriate of ammonia with chalk, as hereinbefore described, as well as that obtained by the distillation of the liquid, as also hereinbefore described, or by any of the other modes hereinbefore described, we employ over again, to convert other portions of common salt into carbonate of soda, according to the plan detailed in the first part of this specification. The common salt separated from the muriate of ammonia, as before described, we again employ with other portions of common salt in subsequent operations. The residue found in the retorts after the sublimation of the carbonate of ammonia, is chiefly muriate of lime, or chloride of calcium, which may be used as before mentioned. In all the operations we have described for the manufacture of carbonate of soda, we employ vessels or apparatus of such construction as to expose the carbonate of ammonia employed as little as possible to the air, so that loss of ammonia may be prevented.

We do not claim as our invention, any particular form of vessel or apparatus in which our operations are conducted, nor any of the chemical substances above mentioned as such; but we claim as our invention or improvements, the use of carbonate or bicarbonate of ammonia in converting common salt into a carbonate of soda, as hereinbefore described; and as this mode would be too expensive to be profitable, if we could not recover the ammonia used for this purpose, so as to make it available for repeated operations, we claim in combination with the former part of the process, as hereinbefore described, the recovering the ammonia which would otherwise be wasted.

Lond. Jour. Arts & Sci.

Progress of Practical and Theoretical Mechanics and Chemistry.

Transfers from Copperplate to Zinc or Stone.

The Silver Isis medal and five pounds were voted to Mr. R. Redman, for his Method of making Transfers from Copperplate Printing to Zinc or Stone.

The object aimed at by Mr. Redman is to make a transfer of copperplate engraving to zinc, retaining, at the same time, the whole, or nearly the whole, of its original sharpness and distinctness. The same process may be applied to making a transfer from stone to stone or zinc, and thus obtaining two or more plates of the same subject; which has been found to be a great advantage when a great number of impressions are required, or a smaller number in a shorter time than can be taken off from a single plate or stone.

The first part of the process consists in taking an impression from the copperplate in the usual way, but with a peculiar ink, on transfer paper peculiarly prepared.

The composition of this ink, which he calls chemical ink, is as follows:

3 oz. of shell lac;
1 — mastich;
1½ — yellow bees' wax;
½ — tallow;
4 — hard curd soap, and lamp-black enough to colour it.

The above ingredients are to be mixed together most intimately, and are then to be burnt in a pipkin for ten minutes, stirring the mass carefully all the time. The residue by exposure to the air becomes damp; so that by pounding it in a mortar it concretes into a paste of a very stiff consistence, and in this state is called, by Mr. Redman, *hard ink*.

One part of this hard ink, rubbed and ground with two parts of common

stiff lithographic ink, forms the transfer ink; which being applied to the surface of an engraved copperplate in the usual way, gives an accurate impression to prepared transfer paper.

This latter is prepared as follows:

One quarter of a pound of the best flour is to be mixed with common porter, in such proportion that it shall form, by boiling, a thin paste of a perfectly uniform consistence; which paste is to be laid quite evenly on the smooth surface of a sheet of india paper, and is to be dried gradually.

The impression being obtained on this prepared paper, it is to be transferred in the usual way to a smooth plate of zinc. When the zinc has received the transferred impression, it is to be covered with an infusion of nut-galls, in the proportion of one ounce of galls to half a pint of water, the mixture to be then simmered for ten minutes in any vessel not of iron. The liquor is to be left on the plate for from five to ten minutes, its effect being to neutralise the alkali of the transfer ink, and thus to harden it and prevent it from spreading when sponged with water previous to printing from it.

Specimens of the ink, and of maps and other subjects transferred by Mr. Redman's process, were laid before the Society. Mr. Webb, lithographer, appeared personally before the committee, and stated that impressions transferred by the usual process to zinc plate come off far sharper and better than from stone. He finds no difficulty in using Mr. Redman's ink, for taking transfer impressions from copper. When a zinc plate is laid by, after use, he sponges it over with the infusion of nut-galls, which protects it from oxidation by covering it with a brown film. On trying other inks, in transferring to stone, they sometimes fail—Mr. Redman's never does.

Trans. Sci. Arts.

New Test Liquor for Acids and Alkalies.

The thanks of the Society were voted to Mr. J. Marsh, for his Test Liquor for Acids and Alkalies, prepared from the Petals of the Red Dahlia.

The infusion of the common red cabbage has been long in use in the chemical laboratory, as a test to distinguish acid from alkaline bodies when in solution; and, although possessed of great delicacy in this respect, is still subject to an objection, on account of its becoming so exceedingly offensive in its smell, after having been prepared a few months.

In order to obviate this objection, I undertook some experiments, about two years ago, on the colouring matter of the dark red hollyhock, the purple raddish, and the dark red beetroot; but, during my experiments, I found many objections to all. The beautiful blue colour of the dark red hollyhock, obtained by alcohol, is, however, worthy of notice; but I have not had time to look much to it during my experiments on this subject, my attention being forcibly drawn to the beautifully coloured infusion obtained from the dark varieties of the dahlia, such as the Conqueror of Sussex, Sir Ed. Codrington, Sir E. Sugden, Alman's Splendissima, Parson's Rival, Brown's Ion, Holmes's Rival, Sussex Lima, Metropolitan Perfection, Pasha of Egypt, Robert le Diable, and Sambo,—these being the varieties that I have mostly employed; there are many more equally as good, but they have not yet fallen in my way.

This infusion is easily obtained as follows:—Into an infusion pot, or any common earthen vessel, let as many of the petals of the above-named dah-

lias be lightly pressed, and then boiling hot distilled or good rain-water, sufficient to cover the petals about an inch, be introduced. The best method of keeping them down is by means of a piece of plate-glass, or the foot of a broken tumbler, or even a piece of common porcelain will do very well. The whole may be kept on the hob of a common fireplace, simmering for two or three hours, covered over with a piece of common paper, to keep out any dirt which otherwise might fall in. The liquor is then to be poured off the petals, which will be found almost colourless. To every pint of the infusion add half an ounce of sulphuric acid, keeping the whole slowly stirred with a slip of glass. When quite cold, add to every pint of the mixture two grains of corrosive sublimate dissolved in a portion of the liquor: filter the whole through a piece of coarse cloth, and bottle it up; and it is immediately fit for use.

When wanted for use, the liquor is to be carefully neutralised by ammonia, which gives it a kind of olive colour, and in this state it may be used liquid; or bibulous paper may be dipped in it, and then dried. Either the liquor or the paper will become green with alkalies, and red with acids.

Being desirous of turning to account some of the qualities of this class of flowers now so much cultivated and so generally admired, and also of rendering them useful as well as ornamental, I have made several attempts to fix it as a dye-stuff on cloths, &c.; but have not yet succeeded in my attempts to my own satisfaction.

The great abundance of these flowers, and the ease with which they can be obtained (as they answer every purpose after having been exhibited,) together with the simple method of obtaining this test liquor, will, I hope, be thought worthy of the attention of the Society of Arts. In conclusion, I beg to add, it has been approved of and adopted at the Royal Military Academy and Royal Institution; and any further information that the Society may require in regard to this subject, I shall feel much real pleasure in communicating when the Society may honour me with their commands.

Ibid.

Lettering Marble.

The Silver Medal was presented to Mr. C. H. Page, of the United States, for his Method of Lettering on Polished Marble; specimens of which are placed in the Society's Repository.

The lettering on marble is, for the most part, confined to monumental inscriptions. For this purpose, the surface of the stone is first polished, and the letters are then cut on it by a chisel, and afterwards covered with black varnish, in order to make them more legible. According to Mr. Page's statement, it is not unfrequent for the letterers, (who form a distinct class of workmen) to content themselves with roughing out the letters in the marble, and to finish them up by penciling on the blacking. Such letters, after exposure for some weeks to the air and weather, become illegible in consequence of the blacking having given way in the superficial parts.

Another method, practised chiefly in the country, is to cut the letters in the marble, and then to cover the space between the letters by some varnish impenetrable to the blacking, after which the blacking is laid on with a broad brush, working it well into the letters. When the blacking has become dry, the surface is to be rubbed with pumice or water of Air stone, which removes the blacking or varnish from the face of the marble, without doing any injury to the lettering if proper care is taken. The surface of

the marble must, however, in this case, either be left unpolished or be polished after the lettering; to which latter there are considerable practical objections.

A third method, sometimes applied to marble previously polished, is to cover the letters and spaces between them with black varnish, and, before the varnish has become dry, to remove it from the surface by rubbing it with a piece of cork, or with an edge of soft brass, which will take the blacking off the surface without injuring its polish. This method, however, is applicable only to very dense and fine-grained marble; for if the surface be porous or flawed, the blacking will sink into the spaces, and cannot be got out.

The method proposed by Mr. Page, and practised by him, first at New York, and afterwards when he was in the employ of Mr. Brown, of University street, is as follows:—

Mix size and whiting to a rather stiff mass, and cover with it the surface of the polished marble, the letters having been cut in it after polishing; then, by means of a brush, work the blacking into the letters, the sized surface being of necessity blacked at the same time. The coat of size prevents the surface, even if porous, from absorbing any of the blacking; and when this latter has become dry and hard, by applying the tool of soft brass, either dry or wet, to the surface, both the blacking and size will be readily removed without injury to the letters, or to the whiteness or polish of the surface. The size, by filling the pores at the edge of the letters, prevents the blacking from soaking through the margin, and thus giving a grey, undefined boundary,—an imperfection to which inscriptions on porous marble are very liable; whereas Mr. Page's method preserves the original whiteness of the marble close up to the edge of the letters.

Mr. Page lays no claim to any novelty in the composition of the blacking. The first used by him he imported from New York; but he has since got blacking quite as good from Mr. Mytton, of Vauxhall Road.

Specimens of his method of lettering on marble were shown in its different stages to the Committee, as well as its successful application to inscriptions on Portland stone; this being one of the most porous stones on which inscriptions are ever cut.

Night Signals for River Steamers.

The Silver Isis Medal was presented to Mr. M. Jenning, for his Night Signals for Steamers.

This form of the apparatus is quite simple, consisting of only two lamps. One is white and stationary; the other, being the indicator, is a coloured light movable about the former. It may, therefore, be placed so as to indicate the course which the vessel is steering without regard to the position of the mast.

In small vessels it may be mounted on a standard, and placed either on the paddle bridge or near the bow. But in sea-going vessels it may be placed at the mast-head, or on the topmast, by any suitable attachment; or it may be so constructed as to be hoisted by ropes to the topmast like a flag.

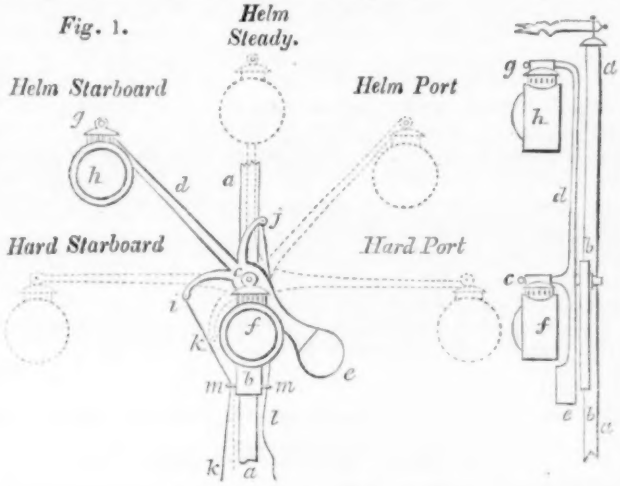
Fig. 1 is a front view, and fig. 2 a side view, of the apparatus as attached to the topmast, of which *a a* is a part: against it is fitted the piece *b b*, from which projects the central pin *c*; on this pin is first placed the arm *d e*, and then the central lamp *f*, so as to swing freely; the top of the arm *d* is also

bent out horizontally at *g*, in order to hold the coloured indicator lamp *h*, and let it swing freely. The end *e* is made heavy enough to bring the lamp *h* perpendicular over the centre light, whenever it is left at liberty so to do. Therefore, to indicate a right or left course, the arm *d* must be pulled aside; for this purpose two smaller arms, *i* and *j*, project from the arm *d*, having lines *k* and *l* fastened to them, fig. 1; these pass through the guide-rings *m m* and descend to the deck or to the captain's station.

In fig. 2, the arm *d* is at liberty; it therefore stands perpendicular: but in fig. 1 it is pulled aside by the line *k* to the position that indicates helm starboard. The captain, by working the lines, *k*, and *l*, informs the vessels ahead what course he is steering, and also indicates to the steersman how he is to put the helm, without the necessity of speaking to him, the back of the lantern being perforated with small holes, through which light enough passes to enable the helmsman to see their position.

Fig. 2. Ibid.

Fig. 1.



Cupping Glass.

The thanks of the Society were voted to J. L. Fenner, Esq., for the following communication describing a very simple and effectual method of applying the cupping glass.

March 6, 1839.

Sir,—I beg to submit to the Society of Arts my invention to render the operation of cupping (whether with the scarificator or as dry cupping) so simple, that the due exhaustion of the glass—the only point of difficulty—may be readily accomplished by any one with unerring certainty, and without the possibility of any accident. I have found, in my practice, that the application of the exhausted glass (dry cupping) has proved a new source of relief in a variety of diseases, especially the neuralgic, to which the effect of most embrocations and liniments bears no comparison. A far greater number of diseases are relieved by dry cupping than by the scarificator; and it has often proved an excellent substitute for a more painful blister. The true reason why such an important means of relief has been kept out

of sight by the profession is, that as medical men seldom practice cupping, they do not acquire the requisite *legerdemain* dexterity with the spirit lamp; and, therefore, the expensive attendance of a professional cupper is necessary. My patients, after once witnessing my mode of exhausting the glass, are in the habit of dry cupping themselves—a triumph of efficient simplicity which no other mode of cupping could ever boast.

Mr. Clarke's ingenious invention for exhausting the cupping glass, which the Society rewarded, answers very well, and is highly creditable to the inventor. What is the reason that it is not in use? Merely from the additional expense of the sets of silver springs to each variety of glass. Those who do not use the spirit lamp resort to the bungling substitute of lighted tow or paper. For the above reasons, cupping is seldom employed by medical men.

My invention removes every obstacle to its general adoption, and is equally cheap, simple, and efficient. I attach a shred of dry lint, or linen, to the bottom of any kind of cupping glass (or, on emergency, to some forms of tumblers or wine glasses) by means of a moistened wafer. A very little spirit of wine is dropped on the lint, and ignited, the mouth of the glass being held downward, so as just to keep the flame burning until brought close to the part to which it is about to be applied. Next, the mouth of the glass is raised so as to allow the spirit to flare up for *an instant;* then the mouth is to be held downward, and when the flame recedes within the edge, the glass is to be quickly applied to the skin, when it will be found to be duly and satisfactorily exhausted.

I have now two delicate ladies under medical treatment, who have been signally benefitted by dry cupping; each, after only once witnessing the operation, performed it on herself the next and successive times. One of them, dispensing with the assistance of vision, on one occasion, applied the exhausted glass to her *back*, and kept it on more than an hour.

J. L. Fenner.

Ibid.

Newly Invented Gas Light.

On Wednesday, 13th May, the Count de Val Marino, the inventor of a new description of gas, for which he has obtained a patent, explained the nature of his invention, and exhibited the apparatus by which it is carried into effect, in the presence of his royal highness the Duke of Cambridge, the Marquis of Douro, Lord R. Grosvenor, Lord C. Somerset, Sir F. Trench, and several other distinguished and scientific persons, who assembled for the purpose in a building attached to the workhouse, in Mount street, Grosvenor square, where the apparatus is now erected, with the view, it is understood, of the gas being used experimentally in some of the streets in the parish. In order to compare the patent gas with that now in use, three lamp posts have been erected at the top of John street, Berkeley square; one of them is lighted with the ordinary gas supplied by one of the public companies, another, having a burner of precisely the same description with the first, is supplied with the patent gas, while the third is not only lighted with the new gas, but is furnished also with a burner invented by the Count de Val Marino.

The apparatus for preparing this new gas was temporarily fitted up for this occasion, and the manner in which the gas is generated was explained in a very satisfactory manner to his royal highness and the company by the

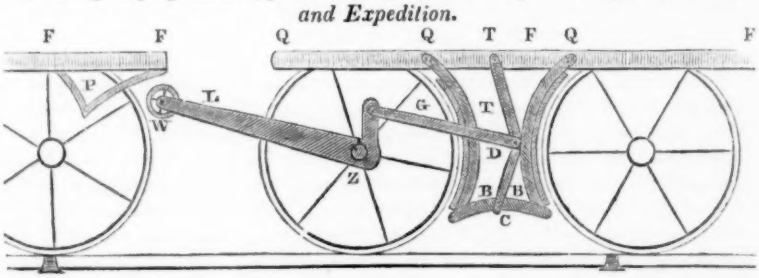
Count de Val Marino, who speaks only in the French language. He pointed out the particular construction of the furnace, and its arrangements in the following manner, as nearly as we could collect the facts:—There are three cylindrical retorts placed vertically side by side, and inclosed in a furnace of suitable dimensions to heat them up to what is technically called a red white heat. This is obtained in a short time, with but a trifling cost for fuel. The requisite heat having been obtained, water is allowed to drop rapidly, but not to stream, into the first retort, and tar into the third one. We must here observe, that the three retorts are charged with coke broken into pieces about the size of a walnut. In the first retort the water is decomposed, the hydrogen is separated from the oxygen, which, uniting with a certain portion of carbonized vapour, produces carbonic acid gas. This product, with the liberated hydrogen, now passes into the second retort, and it is in this retort that the carbonic acid gas is changed into oxyde of carbon by passing through the heated interstices of the coke. The liberated hydrogen, with the other products, unite in the third retort with the superabundance of carbon which is produced by the decomposition of the tar, and thus is formed a pure carburetted hydrogen gas, not requiring any further purification.

The proportions of the water and tar to each other for producing the purest and strongest gas, are, three parts of the former to one part of the latter substance—consequently, the materials being very cheap, the product cannot bear any great price.

This gas seems to be a very active and powerful agent, as it appeared in juxtaposition with the common gas, and when carefully prepared, the flame it produces is clearer, and consequently more bright, than the same surface of the ordinary gas, and there are street lamps lighted from eight to nine o'clock in the evening in the street at the rear of the workhouse looking into Hill street, where the qualities of the two gases can be accurately compared.

Lond. Journ.

Self-acting Safety Brake, for bringing up Railway Carriages with Ease and Expedition.



Sir,—I need not inform the scientific portion of your readers, that a surer and more expeditious method of bringing up railway trains, whilst traveling at high velocities, in cases of emergency, has been a deficiency long felt by those connected with locomotive machinery, and which the following plan will, I think, adequately supply.

Here it will be at once seen, that the old enemy, who hitherto has stared us full in the face, is converted into a friend of no ordinary worth, if there be any truth in the old saw, "a friend in need is a friend indeed."

Supposing a railway train to be traveling at a great velocity, the steam sud-

denly cut off, and a powerful manumotive brake applied to both engine and tender alone, the sudden check will cause the whole train to rush together with considerable violence. Now this property of the carriages rushing upon one another, is converted into the stopping power, or agent, the carriage following, acting upon the brake of the carriage in advance.

The prefixed figure is the carriage in advance, having the new brake attached: the near wheels are removed for bringing the parts into view.

B, B, are the brakes faced with wood, turning upon their centres, Q, Q. C, a curved spring for releasing the brakes, and strong enough to resist the required pressure; T, a knee joint turning freely upon the centres, T, D, E, to which is attached a bar, G, to which latter bar is attached the lever, L, having its fulcrum at Z. Power is to be applied at W, which is depressed by the inclined plane, P, of the following carriage running upon it; W, a roller the breadth of the carriage.

It will be seen from the above plan, that each carriage can be fitted with eight brakes, so that in a train of twelve carriages (the brakes on the last carriage being idle) we should have no fewer than *eighty-eight* brakes ready for action in an instant, and under the immediate control of the engineman and assistants, with the amount of stopping power always coinciding with the momentum of the moving train. Yours, &c.

Manchester, May 25, 1840. WM. JONES.

Lond. Mech. Mag.

Improvement in Mr. Smee's Galvanic Battery.

Sir,—the very superior galvanic battery recently discovered by Mr. Smee, in which platina is precipitated upon silver, or copper plated with silver, suggested to me the trial of another metal in the place of silver; but before I give an account of these experiments, permit me to state, that since the appearance of your Magazine containing the directions for making Mr. Smee's batteries, I have had one made and tested it. It consists of 24 silver plates, size 7 by 10 inches, divided into six elements or pairs, and although finished but a few days since, I have kept it almost constantly in action, and its effect, as compared with the old batteries, far exceeds the most sanguine expectations I had formed of it.

The expense of the plates was great, and recollecting, while preparing them, that iron immersed in a solution of sulphate of copper, without any previous preparation, almost instantly becomes coated with that metal, the experiment was made with *iron* in nitro-muriate of platina. To my surprise, a coating of platina formed on the iron almost immediately, and with much greater facility than on the silver plates. In consequence, a battery has been made of 20 small iron plates, platinized, of about 2 inches by 3 in size, and the result is a power every way equal to a battery of silver plates. The process is in both cases the same, except the washing the plates with nitric acid previous to platinizing; but the iron does not require one-half the time to prepare it that is required by the silver.

Apart from the comparative cheapness of this battery, many other advantages may be mentioned. In using silver, it being susceptible of action from the mercury used in amalgamating the zinc plates, the electric action projects some particles of mercury from the zinc upon the silver plates, and from this cause their action and effect gradually diminish. Iron having less affinity for the mercury than the zinc, is not attacked by it, and no perceptible diminution of its effect or action takes place for hours, and after repeated trials of some

hours each, is found to be as good as at the first immersion. The acid used is the same as directed by Mr. Smee, viz. one part sulphuric to seven parts of water. No porous tubes, canvas or paper bags or sacks, are required to preserve the platina.

I have now in progress a large battery of thirty iron plates to be divided into six elements, or pairs, my object being quantity rather than intensity. I need not dwell upon the advantages this discovery offers in regard to its cheapness, its freedom from noxious gases, or its equal and constant action. I have only ventured this communication in the hope that others possessing greater experience, science, and opportunity than myself, may make still further and more important discoveries.

I am convinced that the *iron battery*, from its many advantages, is an important step towards the adaptation of electro-magnetism to useful mechanical, as well as chemical and scientific purposes.

I remain, Sir, your obedient servant,

Paris, May 31, 1840. JAMES H. PATERSON.

Ibid.

Rain Gauges.

Sir,—In turning over the pages of your useful miscellany, I find at page 163, vol. viii., the following method of constructing a rain gauge:—

"Take a funnel whose opening is exactly ten square inches, and fix it in a bottle; as the rain descends it will fall into the funnel, and from thence into the collecting vessel. The quantity of rain caught is ascertained by multiplying the weight in ounces by .173, which gives the depth in inches and parts of an inch."

This rule will be limited in its usefulness from the circumstance that parties wishing to construct such a gauge may not be able to command a funnel the area of whose opening is precisely ten inches. How many shops may require to be searched before one can be found, or who will undertake to make one, the diameter of whose opening shall be 3.568 inches? In these circumstances, it occurs to me, that a method of finding a multiplier adapted to any other area of funnel may be acceptable. If you are of the same mind, I shall feel obliged by your giving insertion to the following:—

Let d=the diameter of the opening of the funnel; then will $d^2 \times .7854 =$ its area. Also, let $a =$ the altitude of the column of rain fallen; then will its contents, or the quantity received by the funnel, be expressed by $a\ d^2 \times .7854$. Now, a cubic foot, or 1728 cubic inches of water weighs 1000 ounces avoirdupois. Therefore, to find the weight of the quantity of rain received by the funnel, we have the following analogy:—

$1728 : ad^2 \times .7854 :: 1000 : ad^2 \times .454$. That is, calling the weight w, $ad^2 \times .454 = w$. Whence, $a = \frac{w}{d^2 \times .454} = w \times \frac{2.2}{d^2}$ Hence, the rule is, *divide the constant quantity* 2.2 *by the square of the diameter of the funnel; the quotient will be a number by which, if the weight in ounces of the rain in the receiving vessel be multiplied, the product will be the height in inches of the column of rain fallen.*

This multiplier once found, it will be advisable to inscribe it on a conspicuous part of the funnel to which it corresponds.

To exemplify the rule, I may give an example: suppose the diameter of the

funnel is 6½ or 6.5 inches. Then $\overline{6.5}|^2 = 42.25$; and $\frac{2.2}{42.25} = .052$, the multiplier required. Or take as another example the funnel, the area of whose opening is 10 inches. The area being equal to $d^2 \times .7854$, we have $\frac{10}{.7854} = 12.7324 = d^2$. Hence, $\frac{2.2}{12.7324} = .1728$, the correct multiplier, instead of .173, as stated in the article I have quoted. Now, if the rain collected in the receiving vessel weigh 27½ or 27.5 ounces, we have in the case of the first funnel, $27.5 \times .052 = 1.43$ inches, and in the case of the second, $27.5 \times .1728 = 4.752$. I am Sir, your obedient servant, Q.

Aberdeen, May 4, 1840. Ibid.

NOTICES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Analysis of Osmiuret of Iridium. By M. DOBEREINER. (*Ann. de Pog. t.* 35.)

Having melted osmiuret of iridium with persulphuret of sodium, and washed the mass in water, we have a deep green liquor, from which acids precipitate sulphurets of a deep gray colour. The residue of the washing is afterwards completely oxidized by treating it with one part of carbonate of potash and two parts of nitre.

The osmium is easily precipitated, even from its alkaline solutions, by formic acid. It then appears in the form of a deep blue powder, and is so combustible that it detonates with chlorate of potash. Ann. des Mines, tom. xv.

Note on the metal-cleansing property of a double Chloride of Zinc and Antimony. By M. GOLFIER-BESSEYRE.

There is a double chloride formed of joint equivalents of chloride of zinc and sal-ammoniac, easily crystalized, sometimes in plates and sometimes in prisms, according to the dilution or acidity of the medium; but always forming rectangular parallelograms, the solid angles of which are often truncated, so as to present hexagons very often of the diamond form, susceptible of increasing in every direction, and forming either hexahedral prisms or hopper shaped forms, &c.; in short, it has a great tendency to crystalization.

It is very soluble; water takes up more than 1½ times its own weight at common temperatures, and 3½ times at a boiling heat. The solution is very rapid, producing great depression of temperature.

Heat decomposes it into hydrochlorate of ammonia, which sublimes, and chloride of zinc, which dissolves. The most remarkable property of this compound is the facility it affords in tinning or coating metals. It is easy, by means of this salt, to cover copper or iron with tin, lead, or zinc; zinc with tin or lead; and even tin with lead, and the reverse.

It appears to cleanse so well the metallic surfaces to which it is applied, that the metals form, immediately on contact, the alloy on which metallic coating depends; at least it is thus that I explain this singular experiment—of

coating a plate of tin by means of a plate of lead, and reciprocally a plate of the same lead with a plate of the same tin.

The advantages derivable from this are very great; the cheapness with which this substance may be procured allows of its common use. Some of the applications I have already made are—coating a sheet iron kettle with lead simply, which has been in use about two months, for the crystalization of fluids which contain an excess of sulphuric acid, without any alteration being discoverable; all the instruments employed with this kettle, whether of copper or of iron were coated also by means of lead.

From motives of economy, I had several large vessels made of zinc, as well as covers of tubs and boilers; but very soon the united action of air and steam, of heating and cooling, deteriorated the vessels, and oxide of zinc came off from them sometimes in very thick plates;—to have made them of tinned iron would not have comported with my views of economy, and besides commerce furnishes the material only in small sheets. I coated with tin the surfaces exposed to the injury, and I am at present well satisfied with the effect. This double chloride, I conceive, acts as a reducing substance, for I had a large sheet iron stove in the laboratory, so much degraded by oxidation, that in many places it had holes in it. I coated it with lead, and it has become like a new stove.

It is the solution of this substance particularly that must be employed, for it is essential that the surfaces to be coated should be moistened so that the little cavities which oxidation has made may be exposed to its action. I mention this because several persons appear to adhere to the use of it in powder; but it happens in this way as it does with borax in soldering.

If we borax a piece with water holding borax in solution and suspension, its preservative action commences at the boiling temperature; for the water leaves borax over the whole surface of the piece to be soldered; but if we use it in powder, success is much more uncertain, for the powder first calcines, then melts into small drops, which leave intervals exposed to the oxidating action of hot air, and it is only at the temperature of bright redness that it spreads over the surface so as to facilitate the combination of the solder with a metal. Ann. de Chim., Juillet, 1839.

Grease adapted to Carriages and Machines of all Sorts.

This composition prevents friction to a great extent, and of course lessens the wear of all rubbing surfaces. Its cost is not comparatively greater than the materials often employed for the purpose. It is not changed by heat, and hence does not liquify and flow away from its proper place.

Recipe.	Black lead, pulverized, .	50	parts, by weight.
	Hogs' lard, . .	50	do.
	Fresh soap, . . .	50	do.
	Quicksilver, . .	5	do.

At first amalgamate well the lard and mercury, by rubbing them together for a long time in a mortar. Then gradually add the black lead, and lastly the soap, mixing the whole as perfectly as possible. Rec. Soc. Polytech, Jan., 1839.

Application of Caoutchouc Tubes.

By means of these tubes, a person seated in the back part of a carriage may give directions to the coachman, as secretly as he pleases; the latter ap-

plying his ear to the end of the tube outside, perfectly understands the voice within. An application not less useful, is that of a person in a diving bell. By having two tubes of caoutchouc adapted to the bell, one for the descending and the other for the ascending voice, a communication may be held at the depth of 50 or 60 feet, very easily, and much more rapidly than by writing on plates of lead, and transmitting them upwards and downwards, a method sometimes practiced. Idem.

Pancratic Microscope.

This instrument was invented by Prof. Alex. Fisher, of Moscow, and is executed by Chevalier. It has the special advantage of producing at will, without any change of pieces, and by an easy and almost invisible movement, a diversity of magnifying power, varying from 270 to 560 diameters for transparent bodies, and from 75 to 235 for opake bodies. There is, at the same time, indicated on the body of the instrument the degree of enlargement, corresponding to each degree of the elongation of the tube. This advantage, without any sacrifice of the neatness and clearness of the image, will be highly appreciated by observers, who often have occasion to study the same object under different degrees of amplification, occasioning, in the common construction, a considerable loss of time. The committee of the Athenæum of Arts has expressed an entire approval of the ingenious construction of this fine instrument. Idem, Avril, 1839.

Iron Cottages.

A model of a cottage, entirely constructed of iron, has been exhibited in Glasgow, of an elegant structure, and so well adapted to the purposes designed, that no doubt can be entertained of its fitness for general adoption, as well on the English coast, as in the interior. The model contains six chambers, a kitchen, wash-house, and other conveniences. A cottage constructed according to this model, would cost 250*l.* sterling. A double house, that is, one containing fourteen chambers, would cost 500*l.*, which is not half the cost of a similar one built of common materials. Besides, it could be prepared in the course of two months. The iron trade of a country might gain much by this kind of construction. Idem.

Preserving Fruit from late Frosts.

The fruit of trees whose precocious bloom exposes them to the destructive influence of late frosts, may have their flowering retarded by a removal, during the winter, of the earth around the roots; so as to permit the frost to descend deeper, and thus to check the too early ascension of the sap. Many southern horticulturists have resorted to this plan with respect to their almonds, apricots, peaches, &c. In this way the flowering has been retarded more than a fortnight, and late frosts have not attacked them. Idem, Mai, 1839.

Fulminating Mercury. By M. A. Chevalier.

The history of the fabrication of this article in France, may be interesting to many readers. Howard's process for making it is to dissolve 100 grains

of mercury in an ounce and a half of common nitric acid, by measure, aided by a gentle heat. When cold, pour the solution on two ounces, by measure, of strong alcohol, and if action does not immediately ensue, aid it by a little heat. If the effervescence becomes violent, check it by a little cold alcohol or cold water. When the powder ceases to form, separate by a filter, wash it well with water, and dry it by spreading out the filter in the air. From 100 to 122 grains of the fulminate is obtained from 100 of mercury. Its colour is not always the same in every process, but varies from dark to white. It detonates by heat, by percussion, by the flint and steel, and by the electric spark.

After its discovery, it was tried as priming powder, mixed with wax, with alcoholic tincture of benzoin, with nitre, with sulphur, and with sulphur and nitre together.

The manufacture of fulminating powder for priming was commenced in France in 1816, by Julien Leroy, in connexion with his father-in-law. He tried fulminating silver, but was killed by an explosion in his laboratory. After his death, his brother-in law, M. Daguere Leroy, in connexion with a partner, continued the business, but a son of the partner became also the victim of an explosion.

From this time to 1826, various accidents occurred from the detonation of fulminating powder, among which was the death of an apothecary at Versailles, and a similar occurrence at Saint-Etienne.

In 1826, M. Gevelot, one of the ablest fabricants of the capital, purchased the materials which had belonged to Julien Leroy, and established a factory at Moulinaux. Some accidents occurred here, but no death.

M. Gevelot afterwards erected a new factory; but, though well managed, an explosion took place in 1827 and another in 1834, which were attended with the death of several persons.

The employment of copper capsules dates from 1819. By these the danger from the use of fulminating compounds in priming powder, was greatly lessened. New factories were started, but various accidents occurred among them:

1st. In 1826 or 1827. A fire having reached the factory of Tardy & Blanchet, at La Gare d'Ivry, the materials exploded and killed several persons who were engaged in extinguishing the fire.

2d. In 1828, at Gentilly, a child engaged in charging the caps, was killed, and another person wounded.

3d. In 1829. By the pressure of the lid of a box, about which were some grains of powder, the owner of a fabric and another person were killed.

4th. At Belleville, one or two persons were killed.

5th. At Joigny, several persons lost their lives.

6th. At La Villette, a man and a woman were killed.

Various other accidents are mentioned in the history of this manufactory. The government enacted strict regulations relative to the manner of conducting it, and notwithstanding the danger it involves, it has become an extensive object of manufacturing industry. In 1835, eight hundred millions of percussion caps were delivered from the factories, from three to four hundred millions of which were exported to foreign countries, and the rest consumed in France. This branch of industry required 80,000 kilogrammes (=176,000 lbs.) of sheet copper, and 200 pipes of alcohol, which paid a duty of 100,000 francs, and from 160 to 170 kilogrammes of nitric acid, 15 to 16,000 of mercury, 7

to 8000 of nitrate of potash, 2000 of sulphuric acid, for cleaning the copper, and 1590 kilogrammes of cast steel.

A manufactory of priming powder was established at Prague, by Bellot, a French chemist, which furnished annually from 40 to 45 millions of caps, but they were differently prepared from those in France. The latter are made of fulminating mercury and nitre; the capsules prepared at Prague, and which it is said answer better, contain sulphur in addition to the fulminate and nitre.

The priming powder is manufactured, in the large way, as follows: Into a large glass balloon are introduced

1 lb. 8 oz. of mercury,

18 lbs. nitric acid, at 36°, as pure as it is possible to obtain it;

the mercury is dissolved by the aid of a gentle heat, and when complete, 8 to 10 or 12 quarts of alcohol are added by degrees. An enormous quantity of hypo-nitric acid, mixed with ethereal vapours, are disengaged, which are so diffused throughout the place as to reach the olfactories of persons on the road, and to affect the workmen very unpleasantly.

When the alcohol has completed its reaction, it is left at rest for some time, then poured out into basins, the liquid drained off, the powder washed with a little pure water, and then separated by filtering through linen bags, placed in glass funnels.

From 26 to 30 ounces of fulminate are obtained from the materials above mentioned. Its quality depends much on the quality of the nitric acid employed.

While still moist, the fulminate is mixed with the third of its weight of nitrate of potash. This operation is performed on a table with a wooden muller, and which, as the materials are moist, is not dangerous.

The next operation is graining. The mixture being too moist to pass through the sieve, it is dried by means of *pulverin*, obtained from the dry cakes; this mixture is made in stone vessels, and is liable to produce detonation. It may be done on a hair cloth, or on stretched muslin. It is granulated by a hair sieve.

The granulated powder is put on papers, which are placed on thin wooden boards, and adjusted on small tables around the drying room; when taken to the sifting place, these papers should be thrown into water, or, better, into muriatic acid.

The sifting is done on a hair sieve. By this the powder is divided into two parts; the coarser being the powder, and the finer the *pulverin*. The former is then to be put into bottles or pouches made of leather which has been boiled, or of varnished pasteboard, and deposited in the *powder room*, expressly isolated and kept carefully locked.

The prepared powder is afterwards divided in little pasteboard bottles, and taken to the charging room, where it is put into the little capsules, some fabricants adding a small quantity of gum mucilage, that the powder may not get loose and separate from the capsules.

M. Bellot, as has been mentioned, adds sulphur to the other materials in his powder. His proportions are,

Nitre,	1170
Sulphur,	230

This mixture is added to the fulminate in the proportion of

Fulminate of mercury,	350
Preceding mixture,	450

Fulminating powders are carried by pedlars into Germany, it is said, from

France, made by venders in various proportions, some of which I have examined and find to contain from 40 to 60 per cent of nitre.

Certain restrictions, recommended by the committee of safety, are imposed on the manufacture of percussion powder—the principal of which are: the floors of the workshops to be in plaster, as the fulminating powder cannot be exploded on this, though struck by a steel hammer—to bring from the powder room to the charging room, at a time, only one-eighth of the quantity to be used through the day—to sweep the shop often, and to throw the sweepings into a river or stream of water—to keep water in large quantity in the shops—to forbid fire at all times in them, and to warm them, if necessary, only by steam—the factory to be completely at a distance from every dwelling, and from public roads, and to be surrounded by walls—no wire sieves to be employed—the bottles of dried powder to be cased with rushes—the powder room to have a lightning rod, and the floor to be covered with lead—no powder to be poured out or transferred in this room, under any pretext whatever—no factory to be established without a previous submittal of its plan and arrangement to the proper authorities for approbation.

Rec. Soc. Polytech., Juillet et Aout.

Blackening the Hair.

At the Society of Pharmacy in Paris, (Feb. 5, 1840,) on the occasion of discussing a formula for a fluid proper for darkening the hair, as contained in the Pharmacopœia of Geiger, cited by M. Guibourt, M. Robinet stated that in China the colour of the hair is changed by an internal application, (traitement intern) which blackened it for life. A French missionary, who went from France with red hair, returned with black hair, after following this prescription.

Idem.

Progress of Civil Engineering.

Suspension Bridges.—Letter from Lord Western to Lord Melbourne, descriptive of a Suspension Bridge on a new principle, built across the Avon at Bath, by Mr. Dredge. (*Slightly abridged.*)

My Dear Lord—Having heard that Government is about to expend a further sum of money on the reparation of the Menai bridge, which is said to be in a perilous state, I cannot refrain from entreating your attention to the vast improvement that has been made in the construction of suspension bridges, by Mr. Dredge of Bath. During a recent residence of two months in that city, I have had an opportunity of seeing often the bridge built by him across the Avon; it is a beautiful structure, and at once commands admiration by its beauty, and inspires confidence in its stability. I have communicated with him frequently about it, and altogether the consequence has been so strong an impression upon my mind of the *vast* and *immeasurable superiority* of the principle on which it is built, over anything that has hitherto been attempted, that I have been led into this somewhat extraordinary intrusion upon your Lordship, on a matter with which I may be, I own, justly considered to have no very intimate or scientific acquaintance; such, however, is the *simplicity* of the work, that I will not hesitate to at-

tempt some account and explanation of it, in the hope of drawing your attention in the first instance, which if I accomplish, you will be led, I think, to give it a closer examination, which will produce eventually as strong a conviction in its favour on your mind, as it has produced upon mine.

Mr. Dredge's statements of the superiority of the power of his system over the established plan of structure certainly at first astonished me; he has, however, *proved* by *trials* in the presence of very many persons, a superiority of strength to the extent of at least *one hundred and fifty per cent.* These were made upon small models of bridges formed severally on the *present* and on his *new* principles, each out of the same quantity of iron. But Mr. D. carries his calculations of the accumulating power derivable from size and extent over and above the one hundred and fifty per cent. shown upon the small models, to such a degree that I will not venture to state it, but if he should be called upon, in the way I trust sooner or later he will be, to exhibit his system before your lordship and the public, he is confident he can *mathematically* and *practically* establish any of the statements he may make, and I have little doubt he will be found to be correct. He insists on the possibility of reconstructing the *iron work* of the Menai bridge at a *less* sum than the *superfluous iron* would *sell for*—so much less is *requisite* than was *there* used; and he pledges himself to the power of the bridge, if the irons are altogether altered and reconstructed on his principle, to be *capable* of supporting on transit 1000 tons. The Menai bridge is believed to have cost near £150,000, and to have consumed in its construction above *two thousand tons* of iron, and to be declared only capable of sustaining 733 tons on transit. Before I submit to your lordship a detail of some practical experiments Mr. Dredge has made, justificatory of the declarations he thus ventures to put forth, I will endeavour to give some explanation, imperfect though I am sensible it must be, of the fundamental principle upon which his mighty fabric is erected. I must give it merely as it has struck my unlearned common sense, and which it has from *its simplicity*, with a force so irresistible that it makes me believe I fully understand it. *

* * * *I conceive the grand foundation may be said to be the rendering the chains strongest*, and *indeed very much the strongest, at the base, tapering them by regular degrees to the centre*, where they *come at last in fact to a cipher*; from the cipher *commence*, therefore, their *size, weight*, and *strength*, which regularly *increase by degrees* quite *up to its base*, which base, you know, in a suspension bridge, is the towers of masonry on which the chains are hung: in truth it is the application of that *principle horizontally*, which is so obviously necessary in all *perpendicular* erections, of superior size and strength at the base, and *tapering* away to a cipher on its ultimate summit;—as, for example, the obelisk, the pyramid, the church spire; and which principle he shows to be as effective *horizontally* applied, as it is in the *perpendicular*, indeed it may be said to be *far more effective*, as it has to support in so difficult a position, comparatively with the *perpendicular*, its own intrinsic weight, and a heavy transit load besides. * * * * * * *

Mr. Dredge's bridge may be well imagined by supposing a church spire laid horizontally, and met by another of equal dimensions at the point.

There is another figure by which the principle may be more clearly shown; it is the *bracket;* every body knows that the bracket, tapering from its base, will bear horizontally a great weight, but if it was the same size from its base to its extremity, though it might continue to be called a bracket, it would hardly sustain itself if it was any considerable length. I have to

remark now, upon another most important peculiarity in Mr. Dredge's bridge, and that is the diagonal direction of the road suspending rods, instead of the perpendicular, and forming, therefore, as it unquestionably does, a powerful contributary effect to the support of the whole; and this is also most easily capable of direct practical proof. There is a still further point of difference and advantage in Mr. Dredge's bridge, which appears to me equally simple and proveable, and which also essentially contributes to increase its aggregate power and security; that is, its *horizontal action*, or *pressure*, which is also made obvious by a simple and familiar figure representing one-half of a bridge; suppose a straight rod of any given length; fasten a cord at one end of it, and thence to the top of a wall, place the other end to that at which the cord or chain is fastened against the wall, at such a distance below the top of the wall as will render the position of the rod horizontal, and it must be plainly seen that the rod is supported as well by its *compression* against the wall at one end, as by its cord of suspension at the other. Thus every component part of the structure is brought harmoniously to work, and in perfect unity of action towards the grand object.

I will now advert again to the Menai bridge, and show further in essential points the difference between that, and indeed most other suspension bridges, and Mr. Dredge's. The actual intrinsic strain at the centre of the Menai bridge, according to Drewry, p. 167, amounts to 1878 tons, and at each extremity, 1943 tons; this vast intrinsic weight operates in its own destruction, increasing its self-destructive power as it increases in length: thus it becomes vibratory, and upon a gale of wind blowing upon its broadside, it has a swing or pendulous motion; this I have felt myself in passing it, the wind blowing strong at the time.

On the other hand, as I have observed before, upon Mr. Dredge's principle, the *strain* and *weight* only *commence* at the centre, *increasing* as the strength of the bridge *increases* up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined by supposing a ton of iron formed into a bar of equal dimensions from one end to the other, and fixed into a wall; it will hardly support itself, still less any additional load; if extended to any considerable length, it will not support itself; on the other hand, make the same weight of iron into a taper form, and it will support its own weight to any extent, and a heavy extrinsic weight in addition. But further than this, if the parallel equal sized bar is cut away by one-half, it will then support itself and an extrinsic weight in addition. The reason is obvious—it has discharged itself of that which was altogether superfluous, and therefore noxious in the extreme, being wholly destructive of power to carry any extrinsic weight. In this figure is a singularly accurate exemplification of the vice of the Menai bridge, and others built upon the same principle, and the obvious good sense of Mr. Dredge's. Thus, his genius has led him, by the *simplicity* and *perspicuity* of his conceptions, to effect a discovery, which I firmly *believe* will turn out of great national importance, the recognition of which by the country will I am sure be felt by him as the highest possible reward.

Having thus endeavoured to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made, practically substantiating the truth of it, prefacing them however with a brief description of the expense and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations. Its cost was 1650*l.*, its span is 150 feet, and only 21 tons of iron were consumed in

its construction, which at 20*l.* per ton, is only 420*l.*; the great expense, therefore, was on the masonry and the timbers supporting the platform, or road, which are still of insufficient dimensions and strength, but which of course are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons, and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was open for general use; its road is stoned like common roads. In further proof of the correctness of this system, tests have been made before various parties at various times, viz. at Bath, January 2, 1838, before Messrs. Worsams from London, Ball, Cambridge, and others of Bath, with models whose *lengths, deflections*, and *weight were equal*, the chains of each model between the fulcrums were only 9 oz. of wire, their spans were 4 feet 6 inches, their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting 6 sacks of beans on its platform, weighing about 13 cwt.; the taper chain model (new system) bore the 6 sacks of beans, 7 sacks of malt, weighing 10 cwt., 2 cwt. of iron, and 11 men, at the same time, all of which did not break it down. In Bristol, January 6, 1838, before Messrs. Protheroe, Guppy, and others, two other models of equal material and dimensions were tried; the parallel chain model bore 1565 lbs., the taper model bore 3681 lbs. Again, in Bristol, January 10, 1838, more trials were made before Messrs. Acraman, Daniels, Hillhouse, and many other of the first merchants of Bristol, Dr. Waldren and many others of Bath, with models of equal material; the parallel chains bore 1456 lbs., the taper chains bore 3696 lbs. Another trial before the same party, on the same day, was made with models constructed by Mr. Cross of Bristol, unknown to Mr. Dredge, in order to prove that all was fair in the former trials; and the result was, the parallel chains bore 2632 lbs., and the taper chains bore 6849 lbs.; each model broke on adding more weight, and the wire throughout on the taper principle was reduced one size by the experiments.

Now, my lord, all I request is, in the event of further repairs or improvements being about to be undertaken of the Menai bridge, that you will allow Mr. Dredge to exhibit some similar experiments before your lordship, or the Treasury, or before the Bridge Commissioners, and in the presence of any of the most eminent engineers you may choose to summon; finally, my lord, Mr. Dredge declares that such is his thorough conviction of the truth of his theory, and its facility of execution, that he would gladly undertake, at his own expense and risk, the *whole of the iron work*, if he should be allowed to reconstruct it, which he believes he could do, the bridge standing all the time, and that it should be competent to sustain 1000 tons on transit; the superfluous iron of the present bridge he is pretty confident, would pay him and give a balance in favour of government.

Questions may after all fairly be put to me to learn why, with all these advantages of Mr. Dredge's system, exhibited with so much apparent fairness, has not his principle been at once generally acted upon? Why has he not been called upon in many cases to execute what he thus promises? Why, if he can build the proposed Clifton bridge, as he says he could, for one-third or less than Mr. Brunel's estimate, is he not called upon to do so? One good reason is obvious: a prudent caution on the part of the public disinclines them to overthrow long established systems, and to oppose or even question the judgment of long known and respected authorities; this feeling operates very naturally and happily in philosophy as well as in politics, but it should not in either be carried to the extent of checking the progress of

improvement, by well considered means; too great a tenacity for old systems may exist in the minds of many persons, though their motives may be good, and their minds not illiberal; Mr. Dredge's principle of suspension bridge building completely overthrows the theory and practice of a Telford, a Brunel, whose experience and talents we are bound highly to respect, and to whose genius I readily offer the humble tribute of my admiration. Can we then be surprised that the public should evince some fear and some reluctance hastily to adopt Mr. Dredge's novel principle or theory, in substitution of that which has been so long acted upon? They ought, therefore, to pause, they ought to inquire, if there are any persons about to direct the construction of other suspension bridges; it is a duty they owe to those for whom they may be acting, to examine fully into the merits of a novel system which *promises fairly* such advantages, before they determine to persist in the further adoption of the present, of the correctness of which the state of the Menai bridge, and the vast expenditure it occasions, may well create a doubt, independent of the obviously faulty principles on which it is, I think, clearly shown to be constructed. No human being was ever exempt from error, and Messrs. Telford, Brunel, and others, must not be considered to be infallible. I have only to add, my dear lord, that in making this address to you, I have no other motive than the desire of assisting to bring forward genius, and secure for the country the benefit of a most valuable discovery and work of art, which appears to me for want of that encouragement which I think it merits, is in danger, like very many others, of being lost sight of altogether. WESTERN.

To the Viscount Melbourne.

Wood Pavement.

From the experience had, there seems very little doubt but that wood pavements will come into general use in the capital and all great towns. The easiness of draught, the absence of noise, the exceedingly small quantity of wear and tear, give it a superiority over every kind of paving yet used for carriage roads. Nor do these qualities appear to have any *per contra* set off in expense or the rapid wear of the blocks. So far, indeed, from it, that there is every reason to believe, from the experience already had, that ordinary fir blocks will last for many years in their natural state, if well laid, at an insignificant annual expense of repair. And if they were to be Kyanized, there is no telling to what term they may endure, for the wear appears to be exceedingly small.

The principle of wood pavement being once admitted, the next question is, as to the best form of blocks, and the best method of laying them down. In the first specimen laid, at the east end of Oxford street, the blocks were independent hexagons, about nine inches long, and six diameter, the grain being vertical, and the bottom a well prepared Macadamised ground. This stood so well, after twelve months trial, as to bring the wood into immediate reputation. Still it was evident, from the partial subsiding of the blocks, that some improvement was wanting. Though, as a whole, the pavement stood the test of twelve months wear exceedingly well, there was evidently a want of what may be called coherence, or bond of aggregation of the road. Each block stood alone; each had to bear the weight as it came on it, and there was no means of calling in the assistance of its neighbours. If, therefore, every one was not equally strong, or equally well supported,

it naturally gave way, and left the road here and there in hollows, which, though not very glaring, were obvious enough after a shower of rain. From the smoothness of the surface, it also, in greasy weather, became exceedingly slippery.

Succeeding this, was another attempt in the Old Bailey of the same kind, which did not succeed.

Another similar one in Broad street, St. Giles's, required considerable repairing immediately after.

At length, in the summer of 1839, a plan was proposed by a foreigner, (we believe the count de Lisle) in which he proposed forming the blocks in a peculiar rhomboidal shape, by what he calls "a new section," or "stereotomy of the cube." Without following the author through all his details of superiority of this new section, as he calls it, we shall here describe it, and show, as far as we can perceive them, the practical advantages of his plan.

Description.—Let A, B, C, D, fig. 1, be a square, and let the base, D, C, be bisected in E. From E draw A, E, and complete the parallelogram, A, B, F, E, which will be the longitudinal section of his block, the transverse section being a square. If now perpendiculars be let fall from the obtuse angles, E, B, on the opposite sides, A, B, E, F, they will cut the diagonal from the acute angles, A, F, in points, P, Q, which will be the points of connexion or tie for the adjacent rows of blocks. These rows are so placed that alternately they run or lean the same way, but adjacently the opposite. Thus if we suppose the row of blocks, (fig. 2.) A B H I, B C G H, C D F G, all leaning towards the north, the adjacent rows on each side of it, as C B I H, D C H G, E D G F, will all lean towards the south. By this means, the two pins, *a*, *b*, of the block, C B I H, coincide respectively with holes in the blocks, A B H I, and B C G H. So that if they are thus pinned, every block of one row breaks the joints of the adjacent rows, and is pinned to the two whose joints it breaks. Hence there is formed a continuous and compact body, in which the pressure is distributed over a considerable surface.

A *m* B *Fig.* 1.

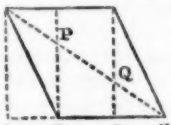
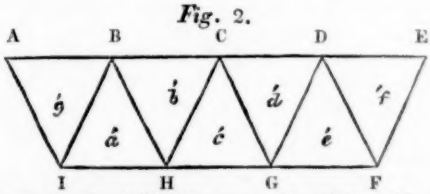


Fig. 2.



If we examine more minutely the properties of these blocks, we shall find a peculiarity in their shape, as thus pinned together, which gives them the power of distributing the pressure much superior to that of the upright hexagonal blocks. In the hexagonal blocks, a weight upon any one block is wholly supported by that block during the entire time the wheel or body is passing across it, if unconnected to the others with pins; and if it is connected, then nearly the whole pressure, if the ground beneath it is at all yielding will be borne by the pins, which must of course tend much to break them. But if we take one of the present blocks, in no instance can it have to sustain the whole pressure for more than over one-half of its surface. For if we refer to fig. 1, we shall see that the block, A B F E, sustains the whole pressure only when the weight is between *m* and B. When between

m and A, it is partly supported by the preceding block, by a direct pressure of one block upon the other. The mere keeping of the two blocks, therefore, together, which the friction of the subsoil does almost alone, would cause a distribution of the pressure over the greater part of two surfaces instead of over one. But the method of pinning them and breaking the joints, really spreads the pressure over a great number of them, and that without any great strain upon the pegs, for the friction of the sub-earth beneath helps much to diminish this strain in the way we have before alluded to. Hence by dividing the pressure over a large range of the blocks longitudinally, the co-operating aid of an equal number on each side of this row is called into action by means of the pegging system, and the individual pressure, therefore, is much extenuated, as well as the strain on the pegs. Indeed the whole body has somewhat the property of a solid, every part being united to the other by the manner of breaking the joints by contra-running rows, and pinning them together. It is thus, in a great measure, independent of unequal hardness of subsoil, and must preserve, much better than the other method can, a more even surface.

In the hexagonal blocks the grain is perpendicular to the road; in these it is parallel to the sides of the blocks, and therefore somewhat oblique to the road; it is said this has been found preferable, and that horses do not slip so much on this sort of road as they do upon the other blocks. If this be the case, it is a curious and highly advantageous property, of which, however, we do not see any physical reason. We have, at different times, paid some attention to this, and certainly have observed, or fancied we have, much less slipping upon the specimens laid down after this plan than after the other plans. This, however, may be in part occasioned by a groove cut longitudinally along the blocks; and, if so, another groove cut transversely would be a still farther safeguard against slipping.

It may be supposed that there would be some difficulty in shaping these blocks, but there is really none. The blocks are cut in long square lengths in the direction of the grain, and the figure is given at once, without waste, by cutting them off in the proper oblique angle. The joints are of course, therefore, between the blocks, far more perfect than it is almost possible they can, by any expense, be made in the hexagonal shape.

Our readers will thus see that the great advantages of this plan consist in accomplishing, by a simple and easy cut figure in the blocks, and proper pinning, a greater uniformity and distribution of bearing, a much more even surface, and consequently a less wear and tear, and less annual expense in keeping the road up. We have heard that so conscious of superiority in the diminished wear are the parties connected with the undertaking, that they decline laying down a pavement unless they also are permitted to contract for the keeping of it in repair.

The patent is now in the hands of a company, and it seems by the interest excited in its favour, that ere long it will become almost the sole and only plan of wood paving, not only throughout London—which there is little doubt will, in a few years, be nearly all paved with wood—but in other large towns of the United Kingdom. We have just heard that an order for one-quarter of a mile of this plan has been given for the town of Manchester.

Our intention was, in the present number, to compare the expense of this sort of pavement with others, for which we have collected some materials, but we find we must defer it to our next.

Railway Mag.

Wood Pavements.

In the wood pavings, the exceeding small wear has been a feature as remarkable as it was unexpected. We all anticipated that the surface of so soft a body as deal would never have stood the heavy weights it appears it does at so insignificant a cost of repair. The general opinion was, that the surface would wear into holes, and quickly give way; on the contrary, the wood has worn with great evenness, and wherever the subsoil has been good, the surface has continued nearly as uniform as it was laid. It is, however, next to impossible to obtain a bottom equally hard in every part, and in that case if the blocks are not pinned together—and pinned in such a manner as to give the least possible strain on the pins—the inevitable consequence must be a subsiding of those where the substratum is less hard, followed by a rough uneven surface. Instances of this kind have occurred in the Old Bailey, and May Hill, leading into Berkeley Square, which were laid with hexagonal blocks. The former, we understand, have been taken up and relaid, and the same is now doing with the latter, which are evident proofs of the system on which they were laid being bad.

The great failing feature in the hexagonal blocks is, besides the want of pins and proper dependence one on the other, the clumsiness of the joints. The blocks, we believe, are hewn into shape, as sawing them truly would probably be too expensive. On this account, the joints are open and filled with dirt, which, in wet weather, is constantly working up, and rendering the surface so unpleasantly slippery. An evident proof of this is in the Strand, where the blocks have all been obliged to be cobbled and repaired before they had been laid down a week. This fault is avoided in the Metropolitan Company's, by having the sides square and parallel to each other, which admit a close joint, and keep out the offending matter.

In the plan of the Company, this Metropolitan Patent Wood, of which we spoke in our last, we understand the wooden blocks are laid on concrete floorings, to give still further advantages to their form and method of pinning. A greater expense is thus incurred at first, but it tells in the end. Thus, for instance, the Company offer to keep their pavement in repair, with the traveling in Oxford street, for 2s. 6d. per square yard per annum, while, under the plan of a Macadamised road, we understand the cleansing alone amounts to £1,400 per annum, or near 1s. per square yard, and the annual repairs to £5,000, or 3s. 6d. per square yard more, making in all 4s. 6d., or nearly double that of the proffered offer to keep the wood in repair.

Again, as to the first outlay. The price proposed to be charged by the above Company is somewhere about 12s. 6d. or 13s. per square yard for laying the pavement with the concrete flooring complete. Compared with the other wood, the hexagonal, which was, we hear, 9s., we confess we thought this high, though it was low in comparison with the advertised price, 14s., of the Imperial, and not a half of what we hear that by Saint Clement's church cost, that is 32s. But it is not the first cost which is the test of expense. Durability is a far more important object. One pavement might be dear at 9s., while another would be cheap at £1. If, for instance, a pavement could be laid at 9s. which would last a year, it would be much cheaper to give £1 for one that would last five years. And if we add the consideration of the inconvenience to the inhabitants, and loss in trade to them, by having their streets every now and then broken up, and their

business for the time interrupted and almost totally suspended, the first cost, to have a durable pavement, sinks into insignificance. But the first cost in wood is trifling compared to that of stone. We have been informed that an estimate to the vestry of St. Marylebone to pave the whole of Oxford street, about 30,000 square yards, with smooth granite, was for £28,000, or near 19s. per square yard, that is about £8,500, or 44 per cent. higher than the price of wood. If tooled granite were used, it probably could not be done under 32s. per square yard, or £48,000; that is no less than 147 per cent. higher. Rough stone might, perhaps, be laid down for £23,000, or about 15s. per yard, but every one knows this would never answer in a street of great traffic.

What is the first cost of Macadamising with granite we have not learnt, but we believe it is much higher than that of the Metropolitan Patent Wood, described in our last number, and the annual expense afterwards is awful. For instance, Blackfriars bridge, which costs £1,000 annually, to keep in repair as a Macadamised road, cost only £120 per annum when paved with stone. One great objection to Macadamised roads too, is the rough, unpleasant state of them when first laid, and another the intolerable dirt and dust of them afterwards, exclusive of noise. Wood is not only less expensive in its first cost, but incomparably so in its subsequent annual maintenance. It has also the great advantage of being in a perfect state when first laid, and, if the plan of the Metropolitan Company is adopted, of maintaining a smooth surface, and not wearing unevenly or sinking into holes, as long as the material lasts, which, if Kyanized, may be very many years.

Now those who have experience in these matters assert that nothing but tooled granite laid in concrete will, in point of wear, compete with good wood pavement, and from what we have seen in Oxford street, this does appear to be the case. If so, there can be no doubt of the great superiority of wood, and that the entire of the capital will, before long, be paved with it; for the very annual saving would, in a short time, amount to the cost of relaying with wood. In Oxford street, under 2½ years cost of repairs would do it, while in the mean time they would enjoy all the advantages of a 2½ years earlier cessation of that noise, dust, and dirt, which it is the object of wood to avoid.

Railway Mag.

Engineers and their Estimates.

We last week slightly touched on the unfortunate errors of engineers in estimating the cost of railways. Had not the subject been brought under our notice, it is not probable we should have alluded to it. It is, however, one of those crying evils which call loudly for redress. Mr. Herapath, in No. 18, vol. i., p. 419, has defended the conduct of engineers, on account of the haste with which they are obliged to rush into railway projects, and to execute them; but however just his observations, and whatever might have been the excuse in the early state of railway enterprise, and when the railway fever was raging, there can be none now. Sufficient experience has been had to make their estimates correctly, or it never will.

Happily railways have all turned out much more fertile in traffic than was ever anticipated, and so far have been favourable to engineers; but still the profits have fallen short on account of the great excess of the cost over the estimates. Had the lines been executed for any thing like the estimates, there is probably not one in the kingdom but would have returned a handsome dividend. But unfortunately the outlay has so enormously

outstripped all expectations, that the returns, though much greater than could ever have been hoped for, have in a few instances been unequal to pay the interest on capital. We shall here give the capital and cost, as far as our knowledge extends, of twenty of the finished railways in the order in which the original acts were obtained.

Names.	Estimate.	Cost.	Royal Asssent.	Capital at Cost.
	£	£		
Ballochney, . .	18,431	38,431	May, 1826	2.09
Dundee and Newtyle,	30,000	170,000	Do.	5.67
Edinburgh and Dalkeith,	70,125	133,053	Do.	1.90
Glasgow and Garnkirk,	28,479	148,195	Do.	5.12
Liverpool & Manchester,	510,000	1,465,000	Do.	2.88
Clarence, . .	100,000	500,000	May, 1828	3.00
Newcastle and Carlisle,	300,000	750,000	May, 1829	2.50
Leeds and Selby, .	210,000	340,000	May, 1830	1.62
Leicester & Swannington,	90,000	175,000	Do.	1.94
Manchester and Bolton,	204,000	650,000	Aug. 1831	3.19
Belfast and Cavehill,	7,500	38,700	Apr. 1832	5.15
London and Birmingham,	2,500,000	5,500,000	May, 1833	2.20
London and Greenwich,	400,000	733,333	Do.	1.83
Grand Junction, .	1,040,000	1,906,000	Do.	1.84
Whitby and Pickering,	80,000	135,000	Do.	1.69
Durham Junction, .	80,000	130,000	June, 1834	1.63
South-western, .	1,000,000	1,860,000	July, —	1.86
Durham and Sunderland,	102,000	256,000	Aug. —	2.51
London and Croydon,	140,000	575,000	June, 1835	4.12
Brandling Junction,	110,000	336,000	Do. 1836	3.05
			Mean,	2.79

Here is contained a lamentable picture of the sad failures of engineers in precalculating the cost of their works. The nearest approximation to truth is 62 per cent. on the estimates; but the other cases present errors varying up to 467 per cent., the mean error being 180. Now with all the indulgence which may be claimed on the score of novelty, or other circumstances, it does seem difficult to defend such errors as these. However, there are causes, which Mr. Herapath has enumerated in the article alluded to, serving to explain a great portion of them, but not entirely to exculpate engineers. But as these causes no longer exist, there can be no excuse in future for insufficient estimates. We do, therefore, hope hereafter to see the cost of railways calculated with much greater precision. We cannot see why they should not be computed within 10 or 15 per cent. of the truth, as well as any other works. At all events, it will be expected; and we apprehend the man who does not do it must not expect to have a second opportunity of abusing the confidence of the public.

This table affords one or two curious facts relative to what may be called the statistics of railway estimates. For instance, the average estimate is 2.79 times the capital, or 179 per cent. more. So that, taking the estimates as usually made, we must multiply them in round numbers by $2\frac{3}{4}$ to give the cost.

Again, it appears that railways in which the per centage errors have been the greatest, are the small ones, as for instance the Dundee and Newtyle, capital £30,000; the Glasgow and Garnkirk, capital £28,479; and the Belfast and Cavehill, capital £7,500. Those in which the per centage cost has been the least, have been two of £80,000 each, and one of £210,000. There is not a single instance of the cost exceeding the estimate above the average per centage, when the capital exceeds only £120,000, except the Manchester and Liverpool, the Manchester and Bolton, and the London and Croydon Railways. This, therefore, is decidedly against the evidence given by Mr. Robert Stephenson, namely, that the greater the length of line, and of course of the estimate, the greater the difficulty of computing the cost, and the greater the proportional error. In fact, it seems contrary to reason that it should be so. The least reflection would tell us that the greater the scope the greater the probability of a balance of errors, if the estimator possessed any skill at all. We have a proof of this in the London and Greenwich, the Grand Junction, and the South-western, in which the per centage excesses of cost are respectively, 83, 84, and 86 each, not a half the average per cent. excess.

With regard to the main question, of whether engineers have gained any thing by their experience, it is difficult to determine much from the foregoing synopsis. Excluding the last three, as railways of small capital, it would appear that engineers have improved a little, and that instead of blunders of 180 per cent., they have reduced them to something under 100 per cent. in the latter cases, which we must own looks like doing better—like having gained something by their experience. If they go on progressing thus, it is possible that in another half century engineers' estimates will come to something near the mark.

The public, however, cannot wait for such slow marches. It thinks that engineers have had sufficient time and experience to learn to make estimates with more accuracy. This has been shown by the reluctance of the public to enter into any new railway speculations. There is no lack of confidence in railway investments, nor any doubt of the traffic equalling and exceeding all reasonable calculations. The objection is to the great uncertainty of the cost. Engineers, therefore, are only doing themselves and the public an injury in not taking some efficient measures to revive public confidence. The only plan appears to us to be, not to be hurried into hasty conclusions, but maturely to examine all the points, and when they have satisfied themselves, to give such an estimate as they know will fairly cover the entire cost, and to bind themselves to execute it for the sum. When the public sees this confidence in their own skill and judgment, it will be induced to go on with these speculations, and to prefer them as investments; but, we apprehend, not before. Ibid.

Atmospheric Railway.

[Some account of the principles on which this ingenious mode of propelling cars on railways was intended to operate, was given in Jour. Frank. Inst. vol. xxiv. p. 210. The following is a detailed statement of the plan and results as actually in practice on a portion of the Junction railway between Birmingham and Bristol. G.]

We attended on Thursday, the 11th ult., at Wormholt Scrubbs, to witness an experiment on a portion of the Birmingham, Bristol and Thames

Junction Railway, which had been laid down by Messrs Clegg & Samuda, on their patent atmospheric principle; as might have been expected, the practical introduction of a system so different from that now in use on other railways, excited considerable interest.

The idea of employing the power of the atmosphere, against a vacuum created in an extended pipe, laid between rails, and communicating the moving power thus obtained to propel carriages traveling on a road, we believe originated with Mr. Medhurst, who laid before the public details of his plan in a work he published in 1827, entitled "A New System of Inland Conveyance;" indeed so far back as 1812 he published some ideas on this method of Locomotion. About 1835 some experiments were made with a model on Wigmore street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed, from the same causes which probably prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making the continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarefaction to be produced. Messrs Clegg & Samuda's invention overcomes this difficulty in a very simple manner; indeed the constructing and closing this continuous valve, by *hermetically sealing it up with a composition* each time a train passes, forms the main feature in their invention.

The portion of the line selected on which the experiments were made is half a mile long, with a rise of 1 in 120 for rather more than half the distance, and 1 in 115 for the remainder. A continuous cast iron pipe or tube 9 inches in diameter, is fixed between the rails, and bolted to the sleepers which carry the rail chairs; the inside of this pipe, which is unbored, is lined with a strong lubrication of pressed tallow about $\frac{1}{10}$ of an inch thick, which equalizes the surface, and prevents any unnecessary friction from the passage of the traveling piston through it; along the upper surface of the pipe is a continuous slit or groove about $1\frac{1}{2}$ inch wide. This groove is covered by a valve extended the whole length of the railway, formed of a strip of leather riveted between iron plates, the top plates being wider than the groove, and serving to prevent the external air forcing the leather into the pipe when the vacuum is formed within it, and the lower plates fitting into the groove when the valve is shut, makes up the circle of the pipe, and prevents the air entering the tube; one edge of this valve is securely held down by iron bars fastened by screw bolts to a longitudinal rib cast on the pipes, and thus allows the leather between the plates and the bar to act as a hinge, similar to common pump valves; the other edge of the valve falls into a groove which contains a composition of bees-wax and tallow; this composition is solid at the temperature of the atmosphere, and becomes fluid when heated a few degrees above it. Over this valve is a protecting cover, which serves to protect it from snow or rain, formed of thin plates of iron about 5 feet long, hinged with leather, and the end of each plate underlaps the end of the next in the direction of the piston's motion, thus insuring the lifting of each in succession. To the underside of the first carriage in each train is attached the piston and its appurtenances; about six feet behind the piston, the horizontal piston-rod is attached to a connecting arm which passes through the continuous groove in the pipe, and being fixed to the carriage, imparts motion to the train as the tube becomes exhausted of the air; attached to the piston rod, and preceding the connecting arm, two steel wheels are fixed, which serve to lift the valve to allow the connecting arm to pass, and also for the atmosphe-

ric air to impinge immediately on the back of the piston; another steel wheel, which is attached to the carriage by a spring, serves to ensure the closing of the valve, by running over it immediately after the piston has passed, in case it should not fall by its own weight. A copper tube about 10 feet long, which is constantly kept hot by a small stove, also fixed to the under side of the carriage, passes over the surface of the composition (which has been broken up by lifting the valve out of it,) and rendering it fluid, which, upon again cooling, becomes solid and hermetically seals the valve. Thus, each train, in passing, leaves the pipe and valve in a fit state to receive the next train.

For the purpose of exhausting the tube a steam engine of 16 horse power is employed, which works an air-pump or exhauster 37½ inches diameter, and 22½ inches stroke, making from 40 to 43 strokes per minute. The air-pump is connected with the exhaust tube in the centre of the railway, by means of a branch pipe 9 inches diameter leading from the air-pump.

To calculate the power of this kind of apparatus, it is necessary to ascertain the state of vacuum and the difference of the pressure of the atmosphere which forces the piston forward; in the present experiments the vacuum was equivalent to from 18 to 20 inches of mercury, which will give for the useful pressure of the atmosphere on the piston about 9lb. on the square inch. The area of the tube, 9 inches diameter, is equal to 63.62 square inches, and this multiplied by the pressure will give

$$9 \times 63.62 = 572.58 \text{ lbs.}$$

for the pressure on the back of the piston, or the moving power.

The load conveyed at each experiment may be taken as follow:—

Two carriages	= 4 tons.
Apparatus attached	= 1 ton.
Forty-five passengers	= 3 tons.
Total load conveyed	= 8 tons.

The stationary engines and air-pumps on this system may be fixed in distances varying from one to four miles apart, to suit the traffic and convenience of the line of road; each section or length of pipe acted on by one engine is confined by two valves; the vacuum is created to about 18 to 20 inches of mercury before the piston enters the pipe, and is maintained during the passing of the train by the engine being kept at work; having passed through one section of pipe, the momentum the train has obtained, serves to carry it on to the next section, which commences at about 100 or 200 yards beyond, and the entrance separating valve of the second section being opened by the carriage immediately after it has entered, allows the vacuum prepared in this section to act upon the piston; thus the train can pass from section to section without end, and without any stoppage.

Experiments.—For the purpose of ascertaining the relative velocity on various portions of the half mile, it was divided into twenty sections of 2 chains or 44 yards each. The carriages were started from a state of rest at the foot of the inclined plane of one in 120, and allowed to run up the incline of half a mile before the break was applied to arrest the progress of the carriages. When two carriages were attached, they run over the ground, after passing the first five divisions at the velocity of 7, 6, 5, and 4 seconds to each section, which is equivalent to 13, 15, 18, and 22½ miles per hour; and when *one* carriage only was attached, it run over the

ground at the velocities of 6, 5, 4, and 3 seconds to each division, which is equivalent to 15, 18, 22½, and 30 miles per hour. The last division in each experiment was done at the greatest velocity, which clearly shows that had the experiment been made on a mile run instead of a half mile, the experiment would have been far more favourable and satisfactory; and if the experiment had been made on a level, about four times the above load might have been conveyed at the same velocity.

We noticed that it took about 1½ minutes to raise the vacuum each trip, to about 18 inches of mercury.

From the above experiments, the loads drawn, and the speed attained, will be as good a criterion of the success of the undertaking as we can have, and when we consider that in producing these results, the patentees must have been wholly unassisted by any previous examples, we think that the greatest credit is due to the talent and ingenuity they have displayed. The system appears to us to possess many advantages which must insure it the serious consideration of the engineer. The carriages travel without noise, and without the risk of explosion, or of getting off the rail. It does not seem possible that a collision of trains can take place, for two trains cannot receive power from the same section of pipe at the same time, neither can they receive power in opposite directions on the same rail. The speed on this system must be proportioned to the capacity of the air-pumps used to maintain the exhaustion in the tubes, and therefore any rate of traveling that may be deemed desirable may be easily attained.

Civ. Eng. Arch. Jour.

Atmospheric Railway.

Monday some experiments were made, at which we were again present, in addition to the public set recorded in our last; but owing to the state of the boiler they added very little information to that acquired from the previous Thursday's experiments. In a couple of trips we attained velocities of 30, or very nearly 30 miles an hour. Had the machinery been in order, and the main tube of a sufficient size, there seems little doubt but that a very high velocity might have been reached.

In the trip principally alluded to, which was the fourth we were present at that day, there was one carriage of 3¾ ton, carrying 14 persons, and the column of mercury exhausted was from 15½ to 16 inches, but the number of strokes of the engine per minute was by some means not recorded.

As the incline was sufficiently great (44 feet per mile) for the carriage to descend by its own gravity, some experiments were made to ascertain what velocity it would attain, and it was found that, however loaded, the greatest uniform velocity was about 9 miles an hour. Sometimes the two-chain distances were run over in 9 seconds, and sometimes in 11, but usually in 10, which gave exactly 9 miles an hour. Now the weight of our carriage was estimated to be 3¾ tons, and if we suppose there was a ton weight of persons in it, the gravitation down the incline was 18⅓ lbs per ton, or $\frac{4\frac{3}{4}\times 2240}{200} = 4\frac{3}{4}\times 18\frac{1}{3} =$ about 86 5-6ths lbs. in all. And by measuring it we found the front surface of the carriage, including the frame, was about 48 square feet, but including the wheels and bodies of the individuals probably not less than 70. By our table, vol. 1 of the octavo series, the resistance

of the atmosphere, per square foot, at 9 miles an hour is .31 lb. and therefore on 70 feet 21¾ lbs. nearly. Taking this out of 86 5-6ths leaves about 65 lbs. for the resistance of the road, or 13.7 lbs. per ton, or in round numbers 14, which, under the circumstances of the carriage, bad rails, and curved road, is probably nearer the mark. This would considerably reduce the apparent loss of power alluded to in our last.

Our readers will perceive that the great points in this invention are the obtaining of a sufficient exhaustion in the main tube to draw the weight by the excess of the atmospheric above the rarified pressure; and afterwards the keeping up of this exhaustion, according to the rate wanted to be traveled. We saw by the experiment recorded in our last that an exhaustion of 19 inches of mercury out of 29 or 30 inches had been made, on a half mile of tube 9 inches diameter, and maintained, while the carriage was traveling, notwithstanding leakage. We might therefore fairly conclude that under similar circumstances, with an engine of 4 times the power, and an air pump of twice the diameter, a main of twice the diameter and 4 times the length, or two miles, might have been better exhausted, and the exhaustion better maintained, with 4 times the load traveling at the same rate. For the leakages upon two miles being 4 times as great, and into a body of air 16 times the bulk, their effect would have been only one-fourth as much, which therefore we think might fairly be set against the extra friction of the air passing through a quadruple length.

Assuming this to be true it becomes a question of first cost and expense afterwards, how far the atmospheric plan is equal, or preferable, to the locomotive. The first cost consists chiefly in the fixed engines, which must be, at farthest, every two miles, and the laying down of the mains, as against the cost of a stock of locomotives, and any saving which might be made in cuttings and embankments. To the credit of the atmospheric plan must also be set that of having rails not exceeding half the weight of the present. With regard to the wear and tear there is no doubt that of the road would be considerably in favor of the atmospheric railway. But the maintenance of the mains and attendance upon them, to see that they are airtight, are items which can only be satisfactorily answered by an appeal to experience. The total duty of the fixed engines will doubtless much exceed that of the locomotives, though the wear and tear will probably not be so great.

With regard, however, to the cost or subsequent expenses, we have not gone into any calculations, but supposing the atmospheric railway brought to perfection, and that the expenses are at all equal to that by the other, there can be no question as to its comfort and superiority over railway traveling by locomotives. Indeed to do away with the locomotives is now the chief *desideratum*, for they are the heavy drawbacks, both in comfort and security, to a system of traveling otherwise as much superior in pleasure and comfort to all others as it is in speed.

Railway Mag.

LUNAR OCCULTATIONS FOR PHILADELPHIA, NOVEMBER, 1840.

Angles reckoned to the right, or westward, round the circle, assecn in an inverting telescope.
☞ For direct vision add 180° ☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
2	6	28	Im. ι Capricorni,	5	139°	140°
2	7	50	Em.		291	310
3	7	17	Im. e Aquarii,	6	117	118
3	8	37	Em.		321	342
5	11	8	N. app. ☽ & 21 Piscium	6, ☽ North 1′.8		
7	13	38	Im. 101 Piscium,	4	149	199
7	14	34	Em.		261	313
9	17	51	Im. g Pleiadum,	5,6	21	75
9	18	6	Em.		351	45
9	17	44	Im. e Pleiadum,	5	75	129
9	18	35	Em.		297	348
9	18	7	Im. m Pleiadum,	7	176	230
9	18	15	Em.		194	247
9	18	4	Im. c Pleiadum,	5	46	100
9	18	39	Em.		324	15
10	5	1	Im. χ Tauri,	6	91	48
10	5	46	Em.		297	249
11	14	44	Im. C Tauri,	4,5	132	157
11	15	37	Em.		218	267
16	15	56	N. App. ☽ & 0′ Sextantis	6, ☽ South 0.′3		
17	18	36	Im. v Leonis	4,5	46	29
17	19	57	Em.		232	237
28	7	17	N. App. ☽ & 4 Capricorni	6, ☽ S. 1′.0		

Meteorological Observations for June, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	62	86	29.73	29.72	S.W.	Moderate.		Clear—do.
	2	54	57	.85	.90	E.	do.		Cloudy—do.
	3	65	68	.80	.72	S.	do.		Drizzle—rain.
	4	65	65	.56	.54	S.E.W.	Calm.	3.44	Fog—rain.
	5	61	78	.56	.66	W	do.		Clear—flying clouds.
☾	6	61	81	.73	.74	N.W.	Moderate.		Lightly cloudy.—do. do.
	7	67	64	.70	.80	S.W.N.W	do.	.93	Rain—cloudy.
	8	48	68	30.02	30.06	W.	Calm.		Clear—flying clouds.
	9	54	70	.08	.02	W.N.	do.		Clear—do.
	10	59	81	.13	.13	S.W.N.E.	Moderate.		Light clouds—do.
	11	64	85	.02	29.97	W.	do.		Lightly cloudy—clear.
	12	67	89	29.83	.87	W.	do.		Clear—do.
	13	71	85	.70	.76	W.	do.		Lightly cloudy—do.
☉	14	62	80	.87	.87	W.	do.		Clear—do.
	15	65	69	.81	.83	W.E.	do.	.15	Rain—cloudy.
	16	56	80	.96	.91	N.	do.		Clear—do.
	17	56	80	30.00	30.00	W.	Calm.		Clear—do.
	18	59	65	29.99	29.85	W.	do.	.30	Lightly cloudy—rain.
	19	56	74	.72	.69	N	Brisk.		Clear—flying clouds.
	20	59	68	.61	.61	S.W.	do.		Clear—flying clouds.
	21	58	81	.71	.74	W.	Moderate.		Clear—do.
☽	22	61	84	.73	.73	S.W.	Calm.		Partially cloudy—do.
	23	67	84	.91	30.00	N.W	do.		Cloudy—do.
	24	64	88	30.00	29.96	S.W.	Moderate.		Clear—flying clouds
	25	67	89	29.83	.80	W E.	Calm.		Clear—do.
	26	65	67	.76	.84	N.E E	Brisk.	.14	Cloudy—rain.
	27	62	79	.84	.81	N.E.	do.		Cloudy—flying clouds
	28	68	83	.80	.80	W.	Calm.		Cloudy—flying clouds.
⊗	29	71	87	.80	.81	S.W	do.		Cloudy—flying clouds.
	30	69	88	.75	.75	S.W.	do.		Partially cloudy—flying clouds.
	Mean	62.10	77.47	29.83	29.83			4.96	

	Thermometer.		Barometer.	
Maximum height during the month.	82.00	on 12th.	30.13 on	the 10th.
Minimum " "	48.00	on 8th.	29.54 "	4th.
Mean	69.785		29.83	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

SEPTEMBER, 1840.

	County.	Town.	Observer.	Thermometer.										Bar		
											Register.					
				7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A.M.	2, P.M.	9, P.M.
1	Philadelphia,	Philadelphia,	J. M. Hamilton,	61.32	66.80	59.46	79.00	49.00	62.53	1 1/3	40.00	57.47	1	30.18	30.12	30.15
2	Montgomery,															
3	Bucks,	Newtown,	L. H. Parsons,	56.80	68.30	54.08	80.50	32.00	59.79	1/3	32.00	46.23	.	30.06	30.04	30.04
4	Lehigh,															
5	Northampton,	Easton,	Charles Elliot,	55.43	68.39	59.10	76.00	45.00	60.97	1 1/3	....	....	.	30.01	29.98	29.99
6	Monroe	Stroudsburg,	A. M. Stokes,													
7	Pike,	Milford,	Ralph Bull,													
8	Wayne,	Honesdale,	W. Richardson,													
9	Susquehanna,	Silver Lake,	E. Rose,	52.10	64.97	55.97	77.00	36.00	57.68	.	35.00	47.70	.	28.14	28.16	28.17
10	Luzerne,	Wilkesbarre,	W. F. Dennis,													
11	Schuylkill,	Port Carbon	P. C. Lyceum,	50.27	70.37	53.43	83.00	36.50	58.02	.	33.00	46.05	.	29.38	29.41	29.42
12	Berks,	Reading,	C. F. Egelmann,	56.50	66.00	55.37	78.00	43.00	59.29	.	...	...	.	29.92	29.94	29.91
13	Chester,	West Chester,	Wm. W. Jefferies,	56.50	69.13	65.83	81.00	39.50	63.82	.	36.00	51.64	.	30.39	30.39	30.38
14	Delaware,	Haverford,	Haverford School,													
15	Lancaster,	Lancaster,	Conservatory of Arts,	55.19	71.52	58.33	82.50	41.50	61.68	1 1/3	38.50	51.78	.	29.55	29.56	29.54
16	York,															
17	Lebanon,															
18	Dauphin,	Harrisburg,	J. Heisely,	58.11	67.54	63.69	76.00	44.00	63.11	3 2/3	46.00	56.72	5	29.81	29.78	29.77
19	Northumberland,	Northumberland,	Andrew C. Huston,	58.55	65.52	58.98	75.00	41.00	60.05	5/3	33.00	45.53	.	29.53	29.51	29.50
20	Columbia,	Danville,	C. H. Frick.													
21	Bradford,															
22	Tioga,															
23	Lycoming,															
24	Union,															
25	Mifflin,															
26	Juniata,	Mifflintown,	J. A. Rinkead,	48.34	72.50	54.42	83.50	33.00	58.42	3 1/3	....	....	.	29.56	29.53	29.54
27	Perry,															
28	Cumberland,	Carlisle,	Prof. W. H. Allen,													
29	Adams,	Gettysburg,	Prof. M. Jacobs,	53.58	69.21	57.79	81.00	36.50	60.19	.	34.00	49.20	.	29.46	29.43	29.44
30	Franklin,															
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	53.37	70.17	56.93	82.00	36.00	60.16	2	....	....	.	29.42	29.39	29.41
32	Centre,	Bellefonte,	John Harris,	46.75	68.89	55.12	79.00	31.50	56.92	10	....	....	.	29.35	29.34	29.35
33	Potter,															
34	M'Kean,	Smithport,	Richard Chadwick,	46.93	66.55	50.29	78.00	32.00	54.59	1	25.00	42.43	.	28.15	28.22	28.12
35	Clearfield,															
36	Cambria,	Ebensburgh,	Richard Lewis,	47.38	65.92	50.70	77.00	33.00	54.67	2 1/3	30.00	41.14	1	27.93	27.96	27.95
37	Bedford,	Bedford,	Samuel Brown,	54.32	69.71	60.59	80.00	36.00	61.54	1	....	....	.	29.32	29.31	29.27
38	Somerset,	Somerset,	George Mowry,	48.05	61.82	51.55	72.50	34.00	53.81	1 1/3	31.00	43.97	2	28.04	28.04	28.04
39	Indiana,	Indiana,	Richard White,	58.93	64.50	54.40	75.00	40.00	59.28	.	....	....	.	28.71	28.70	28.70
40	Jefferson,	Rose Cottage,	C. C. Gaskell,													
41	Warren,	Warren,	C. S. Brown,	55.50	62.17	60.08	73.00	45.00	59.25	6	45.00	54.71	6	28.88	28.87	28.86
42	Venango,	Franklin,	Wm. Connely,	46.33	70.33	55.90	84.00	32.00	57.52	.	....	....	.	29.08	29.12	29.11
43	Armstrong,															
44	Westmoreland,															
45	Fayette,	Uniontown,	J. P. Weithers,	52.90	69.27	55.65	80.50	28.50	59.27	.	....	....	.	29.05	29.08	29.06
46	Green,															
47	Washington,	Cannonsburg,	A. H. Campbell,													
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	59.44	68.44	62.62	78.00	46.00	63.50	5 1/3	....	....	.	29.36	29.32	29.33
49	Beaver,	Beaver,	Wm. Allison,	53.40	69.52	55.97	86.00	36.00	59.63	1	....	....	.	29.50	29.48	29.48
50	Butler,	Butler,	Jacob Mechling,	52.60	66.57	59.63	77.00	40.00	59.60	.	....	....	.	28.91	28.91	28.91
51	Mercer,	West Greenfield,	S. Campbell,													
52	Crawford,	Meadville,	J. Limber,	57.11	68.27	58.04	84.00	45.00	61.14	3 2/3	40.00	49.64	8	28.86	28.84	28.85
53	Erie,	Erie,	Park & Reid,													

LUNAR		Thermometer.								Barometer.					
							Register.								
Day.	H'r.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	
2	6														
2	7														
3	7	59.46	79.00	49.00	62.53	1⅓	40.00	57.47	1	30.18	30.12	30.15	30.39	29.71	30
3	8														
5	11	54.08	80.50	32.00	59.79	⅓	32.00	46.23	.	30.06	30.04	30.04	30.50	29.60	30
7	13														
7	14	59.10	76.00	45.00	60.97	1⅓	....	....	.	30.01	29.98	29.99	30.30	29.70	29
9	17														
9	18														
9	17														
9	18	55.97	77.00	36.00	57.68	.	35.00	47.70	.	28.14	28.16	28.17	28.34	27.60	28
9	18														
9	18	53.43	83.00	36.50	58.02	.	33.00	46.05	.	29.38	29.41	29.42	29.63	28.88	28
9	18	55.37	78.00	43.00	59.29	.	...	...	.	29.92	29.94	29.91	30.16	29.44	29
9	18	65.83	81.00	39.50	63.82	.	36.00	51.64	.	30.39	30.39	30.38	30.62	30.08	30
10	5														
10	5	58.33	82.50	41.50	61.68	1⅓	38.50	51.78	.	29.55	29.56	29.54	29.81	29.06	29
11	14														
11	15														
16	15	63.69	76.00	44.00	63.11	3⅔	46.00	56.72	5	29.81	29.78	29.77	30.03	29.40	29
17	18	58.98	75.00	41.00	60.05	⅔	33.00	45.53	.	29.53	29.51	29.50	29.78	29.11	29
17	19														
28	7														
Moon.	Days														
		54.42	83.50	33.00	58.42	3⅓	....	....	.	29.56	29.53	29.54	29.81	29.13	29
	1														
	2	57.79	81.00	36.50	60.19	.	34.00	49.20	.	29.46	29.43	29.44	29.70	29.01	29
	3														
	4	56.93	82.00	36.00	60.16	2	....	....	.	29.42	29.39	29.41	29.69	28.99	29
☾	5	55.12	79.00	31.50	56.92	10	....	....	.	29.35	29.34	29.35	29.60	29.09	29
	6														
	7	50.29	78.00	32.00	54.59	1	25.00	42.43	.	28.15	28.22	28.12	28.40	27.80	28
	8														
	9	50.70	77.00	33.00	54.67	2⅓	30.00	41.14	1	27.93	27.96	27.95	28.24	27.60	27
	10	60.59	80.00	36.00	61.54	1	....	....	.	29.32	29.31	29.27	29.59	28.90	29
☉	11	51.55	72.50	34.00	53.81	1⅓	31.00	43.97	2	28.04	28.04	28.04	28.29	27.65	28
	12	54.40	75.00	40.00	59.28	.	....	....	.	28.71	28.70	28.70	29.00	28.30	28
	13														
	14	60.08	73.00	45.00	59.25	6	45.00	54.71	6	28.88	28.87	28.86	29.14	28.41	28
	15	55.90	84.00	32.00	57.52	.	....	....	.	29.08	29.12	29.11	29.70	28.60	29
	16														
	17														
☽	18														
	19														
	20	55.65	80.50	28.50	59.27	.	....	....	.	29.05	29.08	29.06	29.38	28.71	29
	21														
	22														
	23														
	24	62.62	78.00	46.00	63.50	5½	....	....	.	29.36	29.32	29.33	29.68	28.92	29
⊗	25	55.97	86.00	36.00	59.63	1	....	....	.	29.50	29.48	29.48	29.80	29.06	29
	26	59.63	77.00	40.00	59.60	.	....	....	.	28.91	28.91	28.91	29.20	28.60	28
	27														
	28														
	29														
	30														
	Mean	58.04	84.00	45.00	61.14	3⅔	40.00	49.64	8	28.86	28.84	28.85	29.08	28.42	28

Maximum
Minimum
Mean

Barometer.				Weather.								Winds.															Hygrometer.					
Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	No. of Report.
30.39	29.71	30.15	⅓	25	6	.	9	....	....	..	2.100	3	.	1⅓	.	1⅓	⅓	•	⅓	3⅔	1⅓	3⅓	⅓	3⅓	⅓	8	1	.	3⅓	....	.	... .	....	.	1289
30.30	29.60	30.04	⅓	17	10⅓	2⅓	9	....	....	..	3.122	2	1⅓	1⅓	.	•	.	.	⅔	⅓	1	7	.	⅓	⅔	14	⅓	.	⅔	....	.	.....	....	.	1277
30.30	29.70	29.99	7	.	.	.	....	....	....	..	.... .	1	.	1⅔	.	⅓	.	⅔	.	1	.	8	.	3	.	9⅓	.	.	5	....	.	.. ..	....	.	1238
28.34	27.60	28.16	.	13⅔	16⅓	.	7	....	....	..	2.180	⅓	.	.	.	⅔	.	⅔	.	3	.	5⅓	⅓	10⅓	⅔	8⅓	.	.	.	....	.	.....	....	.	1233
29.63	28.88	28.40	.	15⅔	14⅓	.	6	....	....	..	1.492	1⅓	.	1	.	3	⅓	2	.	2⅔	.	4	1⅓	2⅔	⅔	2	⅓	8⅓	.	....	.	.....	....	.	1279
30.16	29.44	29.92	.	16⅓	13⅔	.	8	....	....	..	1.487	1	.	1	.	.	.	⅔	.	⅓	.	5⅔	.	2	.	19⅓	.	.	.	....	.	.....	....	.	1240
30.62	30.08	30.39	.	.	.	.	8	....	....	..	.....	5⅔	.	⅔	.	2	.	1⅓	.	4⅓	.	3	.	5	.	8	.	.	.	....	.	.....	....	.	1312
29.81	29.06	29.55	1⅔	19⅓	9	1⅔	7	....	....	..	1.830	3⅔	⅓	.	⅔	⅓	.	1	.	5⅔	⅓	5	.	⅔	1	5	4⅔	.	1⅔	55.11	3	.....	61.72	3	1245
30.03	29.40	29.79	3⅔	.	.	.	5	. ..	....	1	1.534	3⅔	.	⅔	.	⅔	.	1⅓	.	3⅔	.	2	.	3⅔	.	10⅔	.	.	3⅔	....	.	.....	....	.	1217
29.78	29.11	29.51	⅓	10⅓	19⅓	⅓	10	....	....	..	1.278	3	.	3⅓	.	1⅔	.	4	.	4⅓	.	1	⅓	4	⅓	5⅓	.	2⅓	⅓	....	.	.....	62.48	1	1243
29.81	29.13	29.54	3⅓	13	12⅔	4⅓	....	....	....	..	.....	.	.	⅓	.	⅓	.	1⅔	.	.	.	3⅔	.	1	.	4⅔	.	14⅓	4	....	.	.....	....	.	1231
29.70	29.01	29.45	.	20⅓	9⅔	.	7	....	....	..	1.543	5	.	1	.	.	.	1	⅔	2	2	4⅓	1	2	⅓	5	⅓	5	⅓	....	.	.....	....	.	1280
29.69	28.99	29.41	2	.	.	.	7	....	....	..	1.354	.	.	.	.	6⅓	.	.	.	.	.	.	.	21⅓	.	.	.	.	2	....	.	.....	....	.	1235
29.60	29.09	29.35	11⅓	11	8⅔	10⅓	....	....	....	..	2.468	2	.	1⅓	.	.	.	.	.	.	⅔	1⅔	⅓	3⅔	.	3	⅓	3⅓	13⅔	....	.	.....	....	.	1236
28.40	27.80	28.16	1⅓	10	18⅔	1⅓	8	....	....	..	2.925	.	.	.	.	4	.	2	.	.	.	3⅓	.	12⅓	.	3	.	.	5⅓	....	.	.....	64.07	2	1234
28.24	27.60	27.95	2⅓	12	13⅔	4⅓	10	....	....	..	2.525	1⅔	.	.	.	.	.	⅔	.	2⅔	.	4⅓	1	6	⅓	7⅔	⅔	3	2⅓	....	.	.....	...	.	1237
29.59	28.90	29.30	1	17	12	1	.....	....	....	..	.....	.	⅓	.	.	.	.	2⅓	2	.	.	5⅔	3	⅔	8	6	1	.	1	....	.	.. .	....	.	1242
29.29	27.66	28.04	1⅓	13	15⅔	1⅓	5	...	....	..	1.545	1	.	.	.	.	.	1⅓	.	.	.	6	⅔	4⅔	1⅓	2	.	11⅔	1⅓	....	.	.....	....	.	1246
29.00	28.30	28.70	.	19	11	.	10	....	....	..	2.670	.	.	.	.	⅓	⅔	2	.	.	.	5⅔	.	6⅓	.	3⅓	.	11⅔	.	....	.	...	....	.	1504
29.14	28.41	28.87	6	17	7	6	....	....	...	..	.....	⅓	.	⅔	.	.	.	1	.	⅓	⅔	4⅓	.	.	.	2⅔	⅔	13⅓	6	....	.	....	....	.	1230
29.70	28.60	29.10	.	17⅔	11⅔	⅔	6	....	....	..	1.335	.	.	.	.	.	.	4⅓	.	.	.	5	.	⅓	.	19⅓	.	.	1	....	.	.....	....	.	1232
29.38	28.71	29.06	.	24⅓	5⅓	.	....	....	....	..	.....	⅓	.	1⅓	.	.	.	.	.	⅔	.	7⅓	.	6⅔	.	7	.	6⅓	.	....	.	.....	....	.	1271
29.65	28.92	29.34	5⅓	9⅔	15	5⅓	6	....	....	..	2.204	⅓	.	.	.	1	.	3	.	⅓	.	1⅔	.	5	⅓	1⅓	.	11	6	....	.	.....	....	.	1244
29.80	29.06	29.49	1⅓	17	11⅔	1⅓	....	....	....	..	.....	.	.	1⅔	⅓	1⅔	.	4	.	.	.	4	.	1⅓	⅔	9	⅓	5⅔	1⅓	....	.	.....	....	.	1376
29.20	28.60	28.91	.	.	.	.	7	...	....	..	3.545	.	.	⅔	.	6⅓	.	1⅔	.	⅔	.	5	.	13	.	3	.	.	.	....	.	.....	....	.	1239
29.08	28.42	28.85	3	13	14	3	9	....	....	..	3.891	2	.	.	.	⅔	.	.	.	6⅓	.	3⅓	.	3⅓	⅓	8⅔	.	2⅓	3	....	.	.....	....	.	1241